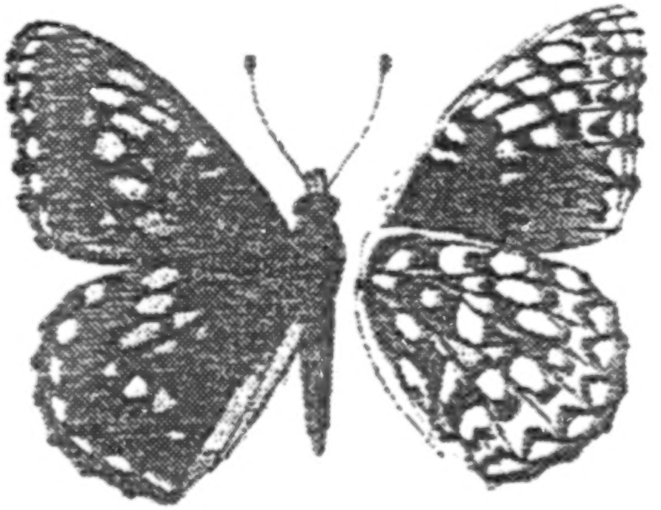
OCT 31 1997

0612

I 49.2:SE 8/2

Draft Recoverry Plan for Seven Coastal Plants and the Myrtle's Silverspot Butterfly

Northern and Central California,
Humboldt County south to
Santa Barbara County



US Department of the Interior
Fish and Wildlife Service
Portland, Oregon

August 1997

JB 98-012491

BEST COPY AVAILABLE

COMPLETED

BLANK PAGE

SEVEN COASTAL PLANTS AND THE MYRTLE'S SILVERSPOT BUTTERFLY

DRAFT

RECOVERY PLAN

Region 1
U.S. Fish and Wildlife Service
Portland, Oregon

SEPTEMBER 1997

Approved: XXXXXXXXXXXXXXXXXX
Regional Director, U.S. Fish and Wildlife Service

Date: XXXXXXXXXXXXXXXXXX

DISCLAIMER

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service **only** after they have been signed by the Regional Director or Director as **approved**. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

LITERATURE CITATION

U.S. Fish and Wildlife Service. 1997. Seven Coastal Plants and the Myrtle's Silverspot Butterfly Recovery Plan. Portland, Oregon. 117 pp.

Additional copies may be purchased from:

Fish and Wildlife Reference Service:
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814

telephone: 301/492-6403 or 1-800-582-3421
fax: 301/564-4059
e-mail fwrs@mail.fws.gov

Fees for plans vary depending on the number of pages.

ACKNOWLEDGMENTS

A rough draft for this recovery plan was prepared by the Habitat Restoration Group, Felton, California, under contract to the Service. Service biologist Heather McSherry reviewed early drafts of this document. Comments and additional information were provided by Cynthia Roye (California Department of Parks and Recreation), Gary Fellers (Biological Resources Division, United States Geological Service), James Willison (Department of the Army), Joey Dorrell-Canepa (Pebble Beach Company), Andrea Pickart (The Nature Conservancy), Virginia Norris (California Native Plant Society), Scott Sinclair (Six Rivers National Forest), Teresa Sholars (College of the Redwoods), Edward Horton (Pebble Beach Company), and participants in the Seven Coastal Plants Recovery Workshop sponsored by the California Department of Fish and Game): Dave Allen, Anthony Lobay (City of Pacific Grove), Bruce Cowan, Diane Elam (US Fish and Wildlife Service), Grey (University of California Natural Reserve), Ken Gray (California Department of Parks and Recreation), Deb Hillyard (California Department of Fish and Game), Jane Holte, Sarah Koenig (Point Reyes National Seashore), Patti Kreiberg (Sunset Coast Nursery), Corky Mathes (California Native Plant Society), Tom Moss (California Department of Parks and Recreation), Lee Otter (California Coastal Commission), Terry Palmisano (California Department of Fish and Game), Renee Pasquinelli (California Department of Parks and Recreation), Bob Soost and Dean Taylor (California Native Plant Society), and Vern Yadon.

EXECUTIVE SUMMARY OF THE RECOVERY PLAN FOR SEVEN COASTAL PLANTS AND THE MYRTLE'S SILVERSPOT BUTTERFLY

CURRENT SPECIES STATUS: These species are listed as endangered except for the threatened *Chorizanthe pungens* var. *pungens*. As of 1997, the following numbers of populations and individuals were known to exist:

species	# of populations	# of individuals
Chorizanthe howellii	3	23,700
Chorizanthe pungens var. *pungens*	7	14,000,000
Erysimum menziesii (three subspecies)	16	33,300
Gilia tenuiflora ssp. *arenaria*	15	100,400
Layia carnosa	19	300,000
Lupinus tidestromii	7	433
Myrtle's silverspot butterfly	3	10,000

HABITAT REQUIREMENTS AND LIMITING FACTORS: The plant species are restricted to foredunes and dune scrub vegetation, and to adjacent sandy habitats occupied by coastal scrub or coastal prairie of northern and central coastal California. The butterfly species occurs in the coastal grasslands and scrub, with the larval host plant (*Viola adunca*) in the immediate vicinity of Point Reyes, Marin County. These species are threatened by competition from non-native plants, loss of habitat from commercial and residential development, and habitat disturbance from recreation and grazing.

RECOVERY OBJECTIVE: To delist these species.

RECOVERY CRITERIA:

- Protection of habitat presently occupied by the species, with long-term committments to conserving the species and the native vegetation.
- In protected habitat, successful control of invasive non-native plants (and snails) and successful management of lesser problems, including grazing, pedestrians, and off-road vehicles. Management success must be demonstrated through ten years of biological monitoring. The time is needed to observe the effectiveness of mangement in dry and wet years.
- The threatened *Chorizanthe pungens* var. *pungens* may be considered for delisting when

iv

permanent protection has been implemented, as currently planned, in the Fort Ord disposal and reuse process.

ACTIONS NEEDED:

1. Protect existing populations and habitats.
2. Minimize the threats to the plants and butterfly.
3. Develop management strategies incorporating ecological and land use strategies.
4. Manage populations and habitats to achieve delisting.
5. Monitor population trends to evaluate recovery success.
6. Coordinate recovery actions to protect other listed and sensitive species.
7. Develop and implement an outreach program.

COSTS (thousands of dollars):

Year	Need 1	Need 2	Need 3	Need 4	Need 5	Need 6	Need 7	Total
1998	26	27	30	80	18	2	6	189
1999	25	27	30	80	18	2	6	188
2000	25	27	30	120	18	2	6	228
2001	25	27	30	40	18	2	6	148
2002	25	27	30	40	18	2	6	148
Total	**126**	**135**	**150**	**360**	**90**	**10**	**30**	**901**

Date of Recovery: Within 10 years of establishing population stability for each species.

TABLE OF CONTENTS

PAGE

I. INTRODUCTION 1
- A. *CHORIZANTHE HOWELLII* 2
  - 1. Description 2
  - 2. Distribution 2
  - 3. Habitat/Ecosystem 3
  - 4. Life History/Ecology 3
  - 5. Reason for Listing 4
  - 6. Conservation Measures 4
- B. *CHORIZANTHE PUNGENS* VAR. *PUNGENS* 5
  - 1. Description 5
  - 2. Distribution 5
  - 3. Habitat/Ecosystem 6
  - 4. Life History/Ecology 7
  - 5. Reasons for Listing 7
  - 6. Conservation Measures 8
- C. *CHORIZANTHE VALIDA* 11
  - 1. Description 11
  - 2. Distribution 11
  - 3. Habitat/Ecosystem 13
  - 4. Life History/Ecology 13
  - 5. Reason for Listing 14
  - 6. Conservation Measures 15
- D. *ERYSIMUM MENZIESII* 15
  - 1. Description 15
  - 2. Distribution 17
  - 3. Habitat/Ecosystem 18
  - 4. Life History/Ecology 19
  - 5. Reasons for Listing 20
  - 6. Conservation Measures 20
- E. *GILIA TENUIFLORA* SSP. *ARENARIA* 23
  - 1. Description 23
  - 2. Distribution 24
  - 3. Habitat/Ecosystem 25
  - 4. Life History/Ecology 25
  - 5. Reason for Listing 26
  - 6. Conservation Measures 27
- F. *LAYIA CARNOSA* 29
  - 1. Description 29
  - 2. Distribution 30
  - 3. Habitat/Ecosystem 31
  - 4. Life History/Ecology 31

5. Reasons for Listing 32
6. Conservation Measures 33
G. *LUPINUS TIDESTROMII* 35
1. Description 35
2. Distribution 36
3. Habitat/Ecosystem 36
4. Life History/Ecology 36
5. Reasons for Listing 37
6. Conservation Measures 37
H. MYRTLE'S SILVERSPOT BUTTERFLY 38
1. Description 38
2. Distribution 39
3. Habitat/Ecosystem 41
4. Life History/Ecology 41
5. Reasons for Listing 42
6. Conservation Measures 43
I. STRATEGY OF RECOVERY 44

II. RECOVERY 91
A. OBJECTIVE AND CRITERIA 91
B. NARRATIVE OUTLINE FOR RECOVERY ACTIONS ADDRESSING THREATS 94
1.0 Protect habitat of the listed species and their populations on private lands 94
2.0 Minimize threats to the plants and butterfly 97
3.0 Develop management strategies through a research program to document the listed species' life histories and their ecological and population parameters 98
4.0 Manage populations and habitats 100
7.0 Develop and implement an outreach program 108
C. LITERATURE CITED 109

III. IMPLEMENTATION SCHEDULE 114

LIST OF TABLES

NUMBER PAGE
1 Summary of Population Data for *Chorizanthe howellii* 45
2 Summary of Population Data for *Chorizanthe pungens* var. *pungens* 46
3 Summary of Population Data for *Chorizanthe valida* 49
4 Summary of Population Data for *Erysimum menziesii* ssp. *menziesii* 50
5 Summary of Population Data for *Erysimum menziesii* ssp. *eurekense* 51
6 Summary of Population Data for *Erysimum menziesii* ssp. *yadonii* 52
7 Summary of Population Data for *Gilia tenuiflora* ssp. *arenaria* 53
8 Summary of Population Data for *Layia carnosa* 55
9 Summary of Population Data for *Lupinus tidestromii* 57
10 Summary of Population Data for *Speyeria zerene myrtleae* 59

LIST OF FIGURES

NUMBER PAGE
1 Plant Identification - *Chorizanthe howellii* 60
2 Approximate Distribution of *Chorizanthe howellii* 61
3 Plant Identification - *Chorizanthe pungens* var. *pungens* 62
4 Approximate Distribution of *Chorizanthe pungens* var. *pungens* 63
5 Plant Identification - *Chorizanthe valida* 64
6 Approximate Distribution of *Chorizanthe valida* 65
7 Plant Identification - *Erysimum menziesii* ssp. *eurekense* 66
8 Plant Identification - *Erysimum menziesii* ssp. *menziesii* 67
9 Plant Identification - *Erysimum menziesii* ssp. *yadonii* 68
10 Approximate Distribution of *Erysimum menziesii* ssp. *eurekense* 69
11 Approximate Distribution of *Erysimum menziesii* ssp. *eurekense* 70
12 Approximate Distribution of *Erysimum menziesii* ssp. *eurekense* 71
13 Approximate Distribution of *Erysimum menziesii* ssp. *menziesii* 72
14 Approximate Distribution of *Erysimum menziesii* ssp. *menziesii* 73
15 Approximate Distribution of *Erysimum menziesii* ssp. *menziesii* and *Erysimum menziesii* ssp. *yadonii* 74
16 Plant Identification - *Gilia tenuiflora* 75
17 Approximate Distribution of *Gilia tenuiflora* ssp. *arenaria* 76
18 Plant Identification - *Erysimum menziesii* ssp. *eurekense* 77
19 Plant Identification - *Layia carnosa* 78
20 Approximate Distribution of *Layia carnosa* 79
21 Approximate Distribution of *Layia carnosa* 80
22 Approximate Distribution of *Layia carnosa* 81
23 Approximate Distribution of *Layia carnosa* 82
24 Approximate Distribution of *Layia carnosa* 83

LIST OF FIGURES (Cont'd.)

NUMBER		PAGE
25	Approximate Distribution of *Layia carnosa*	84
26	Approximate Distribution of *Layia carnosa*	85
27	Plant Identification - *Lupinus tidestromii*	86
28	Approximate Distribution of *Lupinus tidestromii*	87
29	Approximate Distribution of *Lupinus tidestromii*	88
30	Identification - Myrtle's silverspot butterfly	89
31	Approximate Distribution of Myrtle's silverspot butterfly	90

I. INTRODUCTION

Seven plants and one invertebrate from the coastal dunes of northern and central California are considered in this recovery plan. Six of the plant species, *Chorizanthe howellii* (Howell's spineflower), *Chorizanthe valida* (Sonoma spineflower), *Erysimum menziesii* (Menzies' wallflower)[1], *Gilia tenuiflora* ssp. *arenaria* (Monterey gilia), *Layia carnosa* (beach layia), *Lupinus tidestromii* (Tidestrom's lupine), and the invertebrate Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*) were listed as endangered on June 22, 1992 (U.S. Fish and Wildlife Service 1992). *Chorizanthe pungens* var. *pungens* (Monterey spineflower) was listed as threatened on February 4, 1994 (U.S. Fish and Wildlife Service 1994).

These plant species are restricted to foredune and dune scrub communities and adjacent sandy habitats occupied by coastal scrub or coastal prairie. The butterfly species occurs in coastal grasslands and scrub, both in marine terraces and in stabilized coastal sand dunes. The primary threats to the seven plant species, the silverspot butterfly, and its larval food plant, are competition from invasive non-native plant species, commercial and residential development, off-road vehicle (ORV) use, other recreational uses, and cattle grazing. In addition, Myrtle's silverspot butterfly is threatened by overcollecting.

Public lands provide habitat for populations of the species in this plan, including lands under the jurisdiction of the California Department of Parks and Recreation (DPR), National Park Service (NPS), Department of Defense (DOD), and Bureau of Land Management (BLM). Several populations are currently managed for species preservation. Some land agencies have developed management plans but have not yet implemented the recommended actions. Several of the endangered plant populations and one butterfly population occur on private lands. Some are in protected status through dedicated conservation easements.

---

[1] Changes to the taxonomy of *Erysimum menziesii* after it was listed are explained on page 13.

This recovery plan summarizes current knowledge of the taxonomy, current distribution, habitat and biology of the seven plant taxa and the butterfly. Measures are recommended for a program that will meet the plan objectives to de-list the species.

A. *CHORIZANTHE HOWELLII* (Howell's spineflower)

(Recovery Priority Number - 8)[2]

1. Description

Chorizanthe is a genus of herbs in the buckwheat family (Polygonaceae) with many species in California. *Chorizanthe howellii* (Howell's spineflower) was described in 1934 by George Goodman. Its name honors John Thomas Howell, who had collected specimens in 1929. Chromosome counts of this species ($n = 40$) indicate that it originated as a hybrid (Reveal and Hardham 1989), most likely between *C. cuspidata* var. *villosa* ($n = 20$) and *C. valida*. *Chorizanthe howellii* is an herbaceous annual. The plants are 0.3-1 decimeter (1.2-3.9 inches) tall and 1-5 decimeters (3.9-20 inches) across. The basal leaves are 1-3 centimeters (0.39-1.2 inches) long and 5-15 millimeters (0.2-0.6 inch) wide. What appears to be a spiny flower is in fact mostly the involucre that surrounds the flower, tipped with 6 brown, straight spines (awns). The involucre, including its spines, is 3-4 millimeters (0.1-0.2 inch) long. Flowers are 3.5-4.5 millimeters (0.1-0.2 inch) long. Figure 1 shows the appearance of *C. howellii*.

2. Distribution

Chorizanthe howellii is known, both historically and currently, from coastal dunes north of Fort Bragg in Mendocino County, California. Three populations are known in the dune system south of Ten Mile River. One extended population is in MacKerricher State Park (California Department of Fish and Game [CDFG] California Natural Diversity Data Base [NDDB], NDDB occurrence No. 1, 3, 4, 6, 7, 10), with part of one occurrence extending beyond the State park into adjacent private property (NDDB No. 7). Two additional populations are on private lands. Summary data on these populations are presented in Table 1.

---

[2] The Fish and Wildlife Service prioritizes recovery actions by directing resources first to species facing a high (versus moderate or low) degree of threat, with high (versus low) potential for recovery, and to species with a high level of taxonomic distinctiveness. A species that is the only existing member of its genus comes before a species in a genus consisting of more than one species, which comes before a subspecies or variety. The highest priority is 1, the lowest is 18. The priority system was presented in the Federal Register, vol. 48 (221), page 51985, November 15, 1983.

Chorizanthe howellii covers more than 51 hectares (125 acres) on portions of the United States Geological Survey (USGS) Fort Bragg and Inglenook quadrangles (Figure 2). The largest occurrence (NDDB No. 1) contained more than 20,000 individual plants of *C. howellii*, as reported in 1989 (NDDB 1994); however, in 1994 the entire State Park population was estimated to be much smaller (C. Roye, California Department of Parks and Recreation, *in litt.*, 1996). *C. howellii* is known from 3 populations with 23,700 individuals.

3. Habitat/Ecosystem

Chorizanthe howellii occurs in coastal dunes and adjacent sandy soils of coastal prairies at elevations ranging from sea level to 37 meters (120 feet). In coastal dunes, it is associated with sand verbena (*Abronia latifolia*) and Menzies' wallflower (*Erysimum menziesii*). In coastal prairie habitat, associated plants include two non-native grasses, sweet vernalgrass (*Anthoxanthum odoratum*), and velvetgrass (*Holcus lanatus*), and two species of special concern, Mendocino coast paintbrush (*Castilleja mendocinensis*) and Northcoast phacelia (*Phacelia insularis* var. *continentis*) (Calif. Dept. of Fish and Game 1985a).

4. Life History/Ecology

Dispersal of seeds is facilitated by the spines (on the involucres) which attach the seed to passing animals. The preference of this species for sandy substrate allows seedlings to establish in areas that are relatively free from other competing native species.

The species occurs in areas of relatively mild maritime climate, characterized by fog and winter rains. The fog helps keep summer temperatures cool and winter temperatures relatively warm, and provides moisture in addition to the winter rains. *Chorizanthe howellii* blooms from May through July.

5. Reason for Listing

Chorizanthe howellii is mostly restricted to MacKerricher State Park, where recreational and maintenance activities are the main threats to the continued existence of this species. Recreational activities historically included ORV use and hiker and equestrian traffic that caused habitat degradation. In addition, invasion of the dune habitat by the non-native fig-marigold or iceplant (*Carpobrotus edulis* [formerly *Mesembryanthemum edulis*]), European beachgrass (*Ammophila arenaria*), and burclover (*Medicago polymorpha*), which can outcompete and supplant natives species, is a serious threat to *C. howellii*.

6. Conservation Measures

The MacKerricher State Park Ten Mile Dunes Restoration Plan describes measures to protect and enhance the habitat for *Chorizanthe howellii* within the park (Table 1, occurrences No. 1, 3, 4, 6, 7). Conservation measures undertaken for *C. howellii* have included the elimination of ORV use, limited management of invasive, non-native plants including iceplant, European beachgrass, and burclover, and the augmentation of populations of *Chorizanthe howellii* and *Erysimum menziesii*. MacKerricher State Park has redirected an equestrian trail away from occupied habitat.

An archaeological dig conducted by the University of California, Davis in 1989-90 disturbed occupied habitat. Seed was collected in the summer of 1989 before the dig began. Plants were grown at the California Conservation Corps (CCC) Napa nursery and outplanted by the CCC in February 1990. The project had very limited success (Teresa Sholars, CNPS, *in litt.* 1997).

B. *CHORIZANTHE PUNGENS* VAR. *PUNGENS* (Monterey spineflower)

(Recovery Priority Number - 15)

1. Description

Chorizanthe pungens var. *pungens* or Monterey spineflower was first described by George Bentham in 1836 based on a specimen collected from Monterey, collected by David Douglas in 1833. Later, Charles Parry (1889) assigned specimens he had collected in 1888 from the Salinas Valley to *C. douglasii* var. *albens*. Parry's collections and existing populations in the Salinas Valley are now assigned to *C. pungens* var. *pungens*. *Chorizanthe pungens* var. *pungens* is classified as a separate variety from var. *hartwegiana* (Ben Lomond spineflower) of the Santa Cruz Mountains. *C. pungens* var. *pungens* has involucral lobe margins (edges of the spines) that are white (rarely pinkish) rather than dark pinkish to purple and the plants tend to be prostrate rather than erect (Reveal and Hardham 1989). The involucre's awns are hooked at the tip (uncinate), while the spines of *C. howellii* are straight. Chromosome counts of *C. pungens* are $n = 20$ (Reveal and Hardham 1989). Figure 3 shows the morphology of *C. pungens* var. *pungens*.

2. Distribution

Chorizanthe pungens var. *pungens* occurs from the Monterey Peninsula (Monterey County) northward along the coast to southern Santa Cruz County, and inland to the Salinas Valley (Reveal and Hardham 1989, Ertter 1990). Early collections by Gambel in 1842 indicated that this species historically occurred as far south as San Simeon near the northern boundary of San Luis Obispo County, however, in recent times this species has not been found south of the Monterey Peninsula (Reveal and Hardham 1989). The occurrence of *C. pungens* var. *pungens* in the Salinas Valley is now limited to a few populations near Prunedale (Reveal and Hardham 1989). The northernmost population occurs in Day Valley near Soquel in Santa Cruz County. Available summary data on these populations are presented in Table 2, and the occurrences are mapped in Figure 4.

Surveys have been conducted at Fort Ord in recent years in preparation for closing the base. In 1992, Jones & Stokes Associates found *Chorizanthe pungens* var. *pungens* in almost all the undeveloped areas on the western half of Fort Ord (U.S. Army Corps of Engineers [COE] 1992). These are significant populations, occupying 4,224 hectares (10,456 acres) that represent as much as 70% of the habitat currently occupied by this plant. The occurrences were mapped by low, medium and high densities, leading to an estimate that there are as many as 14 million plants. Because no quantitative surveys were conducted, this estimate is not definitive. Plans call for approximately 60 percent of the habitat to remain in open space, protecting as many as 9 million plants. Vern Yadon (1989) mapped *C. pungens* in Manzanita Park near Prunedale (Monterey County). This is the farthest inland population currently known to exist. Populations are found on State Park System lands at Manresa, Marina, Sunset, Salinas River, and Asilomar State Beaches and Fort Ord Dunes State Park (C. Roye, *in litt.*, 1996).

In 1987, a survey of six properties in the Marina Dunes found a total of 43 individuals of *Chorizanthe pungens* var. *pungens* on five of the properties: Marina State Beach, Granite Rock Company, Gullwing, RMC Lonestar Cement Company, and Martin (Zoger and Pavlik 1987). The population at this site might be more extensive than indicated as the survey was conducted in a poor rainfall year (Dorrell-Canepa, *in litt.*, 1995). Other populations are known from Pebble Beach. In summary, *C. pungens* var. *pungens* is known from seven populations with more than 14 million individuals, the vast majority of them at Fort Ord.

3. Habitat/Ecosystem

Chorizanthe pungens var. *pungens* occurs in coastal dunes, coastal scrub and farther inland on sandy soils derived from ancient stabilize dunes dating to the ice age (pre-Flandrian) (Zoger and Pavlik 1987). This species tends to occur on bare sandy patches with little vegetative cover (Zoger and Pavlik 1987). At Fort Ord, this species was found in firebreaks, along roadsides, in sandy openings between shrubs, the central portion of the

6

firing range, and areas where military activities resulted in frequent habitat disturbances. Other plants associated with this species include beach-bur (*Ambrosia chamissonis*), coastal sagewort (*Artemisia pycnocephala*), and mock heather (*Ericameria ericoides*). The range of another spineflower species, *C. diffusa*, overlaps with *C. pungens* var. *pungens* in the Marina Dunes. It has a lemon-yellow perianth tube which differs from the white to rose floral tubes of *C. pungens*, and tends to favor both gravelly and sandy substrate.

4. Life History/Ecology

Seed dispersal is facilitated by the involucral spines, which attach the seed to passing animals. The preference of these species for sandy substrate allows seedlings to establish in areas that are relatively free from other competing native species; this is particularly true for *C. pungens* var. *pungens* which prefers bare soils. State Park personnel hypothesize that trampling along trails may actually aid germination (C. Roye, *in litt.*, 1996), which could be offset by trampling mortality to the plants.

This plant occurs in areas of relatively mild maritime climate, characterized by fog and winter rains. The fog helps keep summer temperatures cool and winter temperatures relatively warm, and provides moisture in addition to the normal winter rains. *Chorizanthe pungens* var. *pungens* flowers are produced from April through June and the seed is collectable through August (Dorrell-Canepa, *in litt.*, 1995).

5. Reasons for Listing

Habitat loss and conversion for agricultural and residential development, activities at military institutions, and invasion by non-native plants were identified as the primary threats to *Chorizanthe pungens* var. *pungens* (59 FR 5505). Hikers and equestrians may trample this plant at locations throughout its range. Residential and golf course development in maritime chaparral habitat is a potential threat to several populations in

Monterey and Santa Cruz counties. The proposed route realignment of Highway 101 in northern Monterey County also has the potential to affect several small, scattered populations.

Most of the historical locations of *Chorizanthe pungens* var. *pungens* in the Salinas Valley have probably been extirpated by conversion of grassland and valley oak woodland habitats to agricultural fields. The one remaining population near Prunedale is in Manzanita County Park, however, the park has no management plan for this species and this species is threatened in the park by plans to replace the natural vegetation with turf for playing fields (Vernal Yadon, botanist, pers. comm. 1994).

Construction of roads and buildings on Fort Ord possibly destroyed some populations of this species in the past. Conversion of this military base to other uses, including educational and scientific research facilities, may threaten this species if new buildings are constructed, however, large portions of this plant's habitat on Fort Ord are to be reserved for open space (see conservation measures below).

When it was listed, populations of *Chorizanthe pungens* var. *pungens* at Sunset State Beach were threatened by recreational activities, with plants subject to trampling. Invasive non-native species introduced as part of dune stabilization programs were (and still are) a threat at Sunset Beach. Non-native species that have invaded dune habitats and are now widespread include European beach grass and iceplant (*Carpobrotus edulis*).

6. Conservation Measures

Restoration of dunes at the Naval Postgraduate School in Monterey where *Chorizanthe pungens* var. *pungens* occurs may benefit this species. This restoration work has included removing non-native invasive species such as iceplant, converting previous landfills and other semi-dune areas to natural coastal dunes and coastal prairies, and planting native species (Cowan 1994). When work is completed, the total area restored will be about 12 hectares (30 acres). The *C. pungens* var. *pungens* population at Sunset State Beach may be enhanced by a restoration program established for the removal of non-native species (Ferreira 1989). Monitoring of these sites for several years is necessary to determine if the conservation efforts are successful.

For known populations of *Chorizanthe pungens* var. *pungens* (Table 2) on lands within the jurisdiction of the County of Monterey, Policy 2.3 of the North County Land Use Plan (LUP), relating to environmentally sensitive habitats, is applicable. The County of Monterey LUP policies allow only resource-dependent uses in habitats known to support rare and endangered species. The LUP also recognizes dune habitat, with or without rare and endangered species, as an environmentally sensitive habitat. Within environmentally sensitive habitat, the LUP allows resource-dependent uses that do not significantly disrupt habitat values. Land uses adjacent to environmentally sensitive habitats should be compatible within the long-term maintenance of the resource. The County requires the protection of environmentally sensitive habitats in new land divisions or developments through deed restrictions or dedications of permanent conservation easements.

General Code 16.32 of the County of Santa Cruz allows only resource-dependent uses within environmentally sensitive habitat areas, including habitat for rare and endangered species. For proposed land divisions or developments, the County requires protection of environmentally sensitive habitats through dedication of an open space or conservation easement to protect the portion of a sensitive habitat that is undisturbed by the proposed development. Alternatively, the developer may protect sensitive habitat on an adjacent parcel.

For populations of *Chorizanthe pungens* var. *pungens* (Table 2) on lands in the City of Marina, the City's LUP policies support protection and restoration of native dune habitat and vegetation and the habitat of recognized rare and endangered species. The City's policies specify that primary habitat areas for sensitive species be protected and preserved. Development within secondary or support habitat areas is allowed, if it does not significantly affect primary habitat areas. Where development is proposed on parcels containing rare and endangered species, parcel owners are required to develop and execute a management plan that will protect the identified plant species. The City has recently completed the Coastal/Vernal Ponds Comprehensive Management Plan which identifies habitat for *C. pungens* var. *pungens* and *Gilia tenuiflora* ssp. *arenaria* on lands administered by California DPR as part of Marina State Beach (Table 7). The plan recommends management actions to protect the rare plant habitat.

Sand City's LUP expresses the intent to protect and preserve endangered species habitat. The City is developing a Habitat Conservation Plan (HCP) for part of its planning area to protect the endangered Smith's Blue Butterfly (*Euphilotes enoptes smithi*). The plan will protect a small area occupied by *C. pungens* var. *pungens* and *Gilia tenuiflora* ssp. *arenaria*.

Several management plans address *Chorizanthe pungens* var. *pungens*. Marina State Beach and Asilomar State Park staff have implemented an aggressive program to eradicate invasive non-native plants, revegetate dunes, and protect dune habitat from recreational uses (i.e., by using raised wooden walkways). The State has installed interpretive signs that educate the park visitor about the sensitivity of the dune habitat and its listed plant species.

The Department of Defense (DOD) developed the Fort Ord Habitat Management Plan (HMP) that documented the populations within the military facility as part of the base closure plans. The plan delineates the habitats on the site that will be set aside for preservation and which populations may be affected by future development. Designating large portions of Fort Ord as open space will provide conservation opportunities for this species. When Fort Ord was still operating as a military facility, the DOD established small preserves (from 4 to 42 acres) to protect rare species. Under the HMP, BLM will be responsible for portions of the sensitive habitat areas, as will the University of California, Santa Cruz and California DPR. More than 16,000 acres of Fort Ord are slated for preservation as open space and native plant and wildlife habitat by the HMP. Portions of the *Chorizanthe pungens* var. *pungens* populations will be managed by the University as part of its Natural Reserve System. Other portions of the populations will become part of the City of Marina and be subject to City development policies. Guidelines for specific management actions are not outlined.

A population within Manzanita County Park is managed by Monterey County Parks Department. The Park staff is aware of the population, however, management guidelines have not been developed.

C. *CHORIZANTHE VALIDA* (Sonoma spineflower)

(Recovery Priority Number - 5)

1. Description

The Sonoma spineflower, *Chorizanthe valida*, was described by Sereno Watson in 1877 from samples collected in 1840-41 by Ilya G. Vosnesensky, an entomologist and curator of the Zoological Museum in St. Petersburg, Russia, who traveled and collected in northern California. It is very similar in appearance to *C. howellii*, the primary distinguishing characteristic of *C. valida* being the brightly colored red and white involucres. The bright red base of the involucre's straight spines contrasts with their bright ivory tips, and the red spine bases contrast sharply with the dull-colored involucral tube. The basal leaves of *C. valida* are 1-2.5 centimeters (0.4-0.9 inch) long, 4-8 millimeters (0.2-0.3 inch) wide, and often less hairy on the top surface than underneath. The flowers are 5-6 millimeters (0.2-0.3 inch) long. *C. valida* is depicted in Figure 5.

2. Distribution

Only one population of *Chorizanthe valida* is currently known (Figure 6). The location of Vosnesensky's original collection was referred to as "Russian Colony" by Sereno Watson in 1877 when he described the plant. More recently, this site was referred to as "near Fort Ross" and designated as the type locality by Reveal and Hardham (1989). However, Davis and Sherman (1990) proposed that the original Vosnesensky collection may have been taken from the Point Reyes Peninsula in Marin County. The Fort Ross site has been surveyed many times, most recently in 1987, and *C. valida* has not been found. Additional historical collections of this spineflower were recorded from "near" Petaluma and Sebastopol in the interior portion of Sonoma County (Reveal and Hardham 1989). Early collectors, operating without accurate modern maps, often recorded the localities of their collections as the nearest town or settlement. It is possible that the species has always been narrowly endemic to the Point Reyes site (G. Fellers, *in litt.*, 1995).

A population was reported in 1980 at Rodeo Lagoon in Golden Gate National Recreation Area, Marin County, California. That site was surveyed repeatedly between 1984 and 1987, but no *Chorizanthe valida* were found. The sighting at Rodeo Lagoon may have been erroneous.

The only known extant population of *Chorizanthe valida* (NDDB No. 2) is in the Lunny Pasture adjacent to Abbott's Lagoon in Point Reyes National Seashore (PRNS) (Davis and Sherman 1990) (Table 3). This site is on the USGS Drake's Bay quadrangle at an elevation of about 12 meters (40 feet) (Figure 6). The Lunny Pasture population was discovered June 1980, by Wilma Follette and a group of amateur botanists of the Marin Chapter of CNPS (Calif. Native Plant Society [CNPS] 1980). Before then, *Chorizanthe valida* had been thought to be extinct from Point Reyes, with the last collection made by A.D.E. Elmer in July 1903 (Calif. Native Plant Society 1980). The 1903 specimen's location was given as the Point Reyes Post Office, at that time located west of Schooner Bay and north of Creamery Bay in Drake's Estero (Davis and Sherman 1990).

The Lunny Pasture population of *Chorizanthe valida* was estimated to cover 100 square meters (1,076 square feet) in 1983. In 1984, more than 2,000 plants covered an area of 1,564 square meters (16,829 square feet) (Fowler and Fellers 1984). The increase in population area from 1983 to 1984 was probably due to natural population fluctuations that occur in annual species in response to weather conditions (Fowler and Fellers 1984). A 1986 survey estimated that the colony of *C. valida* in Lunny pasture consisted of two distinct subpopulations covering approximately 17,000 square meters (182,920 sq. feet) and well more than 2,000 plants (Clark and Fellers 1986). Subsequent monitoring by CNPS has documented wide fluctuation in numbers, ranging from 2,000 to 30,000 plants (NDDB 1994, Virginia Norris, CNPS Marin Chapter, *in litt.* 1995, R. Soost *in litt.*, 1996). Variation between estimates may be due to undercounting, differences in observer accuracy, or the natural fluctuations between years. In summary, *C. valida* is known from one population with a maximum of 30,000 individuals.

3. Habitat/Ecosystem

Chorizanthe valida occurs exclusively in the sandy soil of a coastal prairie near Abbott's Lagoon, at an elevation of approximately 12 meters (40 feet). The prairie is adjacent to a brackish lagoon, coastal swale, and coastal scrub, but *C. valida* does not grow in those habitats (Davis 1988a). This site is adjacent to the dune system that stretches about 19 kilometers (12 miles) from Tomales Point to Point Reyes (Cooper 1967). Other plants associated with this species include two species of special concern, Point Reyes horkelia (*Horkelia marinensis*) and large-flower linanthus (*Linanthus grandiflorus*), as well as coyote brush (*Baccharis pilularis*) and several annual grasses.

4. Life History/Ecology

Chorizanthe valida is an herbaceous annual in the buckwheat family. Dispersal of seeds is facilitated by the spines, which attach the seed to passing animals. As with other *Chorizanthe* species, this species occurs on sandy substrate, where seedlings establish in areas that are relatively free from other competing native species.

The species occurs in areas of relatively mild maritime climate, characterized by fog and winter rains. The fog helps keep summer temperatures cool and winter temperatures relatively warm, and provides moisture in addition to the normal winter rains. *Chorizanthe valida* blooms sometime between June and August, depending on the year's weather pattern.

Chorizanthe valida has a peak blooming season of only three weeks, after which it rapidly loses color and goes to seed. After about a month, the dull brown flowerhead begins to disintegrate and the spiny seeds are dispersed on the ground nearby. During the blooming period, *C. valida* emits a strong floral scent which attracts many insect pollinators (Davis and Sherman 1990). Honey bees (*Apis mellifera*), yellow-faced bumblebees (*Bombus vosnesenskii*), and solitary ground nesting wasps (*Bembix americana comata*) are known to forage on *C. valida* flowers (Davis 1988b). An insect identified as belonging to the order *Hemiptera: Lygaeidae* also occurs on this plant. The insect closely resembles the seeds in size and color (Davis 1988b).

5. Reason for Listing

The rarity of *Chorizanthe valida* (one extant population) makes it exceptionally vulnerable to disturbances. Development may have led to the loss of the historical mainland populations of this species near Sebastopol and Petaluma, California, if indeed populations existed inland from Point Reyes.

The extant population is within the PRNS in a pasture which has been grazed for over a century. The PRNS issues special use permits to ranchers for dairy and beef operations because the enabling legislation for the park considers that cattle operations merit preservation as part of the cultural heritage of western Marin County (Davis and Sherman 1990).

6. Conservation Measures

Point Reyes National Seashore recommends yearly monitoring of *Chorizanthe valida* and other rare species (Clark and Fellers 1986). Volunteers from CNPS monitor the rare plant populations at PRNS, but not yet on an annual basis.

The possibility that grazing may benefit *Chorizanthe valida* by suppressing competitors has been investigated (Davis and Sherman 1990). Exclosures were built in 1988 and the colony was monitored. A higher density of *C. valida* was found outside the exclosures than inside, and it was suggested that this species may be adapted to a grazing regime. However, the plants inside the exclosures were more than twice as tall as the plants outside, growing as tall as the grasses that were protected from cattle. There were no plants inside the exclosures in 1996 (Hickson *in litt.* 1996).

D. *ERYSIMUM MENZIESII* (Menzies' wallflower)

(Recovery Priority Number - 2)

1. Description

Menzies' wallflower (*Erysimum menziesii*) was first described in 1830 by Sir William Jackson Hooker, Director of Kew Gardens, as a species of the genus *Hesperis*. The type herbarium sheet, containing two intermixed but unrelated plants (the wallflower and *Phoenicaulis cheiranthoides*), was collected by Archibald Menzies in the late 18th century. In 1881, Richard Wettstein, Director of the Vienna Botanical Garden, transferred the name to the genus *Erysimum*. The species consists of four geographically distinct subspecies: *E. menziesii* ssp. *menziesii*, *E. menziesii* ssp. *eurekense*, *E. menziesii* ssp. *yadonii* (Figures 7, 8 and 9), and *E. menziesii* ssp. *concinnum* (not rare).

There has been an important change in the taxonomy of *Erysimum menziesii* since the Service listed the entire species as endangered in 1992. At that time, Robert Price's 1987 doctoral dissertation had already recognized subspecies *eurekense* and subspecies *yadonii*.

but Price had not yet formally published these new names. Nor had Price made *Erysimum concinnum* a subspecies of *E. menziesii*. Price's treatment of the species in the Jepson manual reflects these recent changes (Hickman, ed. 1993). The Service listed what are now ssp. *menziesii*, ssp. *eurekense*, *and* ssp. *yadonii*. The final listing rule made it clear that what is now *E. menziesii* ssp. *concinnum* is not included. The Service will update the List of Endangered and Threatened plants to reflect this change in taxonomy.

A member of the mustard family (Brassicaceae or Cruciferae), this species may be a biennial or a short-lived perennial depending on the particular population. Each plant usually has several flowering stems from 0.5 to 1.5 decimeters (1.2-5.9 inches) tall. The flower petals are usually yellow, 15-20 millimeters (0.6-0.8 inch) long. The flowers are grouped into an inflorescence (branched raceme). The fleshy leaves form a basal rosette and are somewhat spoon-shaped, narrowing abruptly to the leaf stalk. Leaves are 2-11 centimeters (0.8-4.3 inches) long and 4-15 millimeters (0.1-0.6 inch) wide, and the leaf margins are entire, dentate, or lobed. The fruit is a silique, 3-13 centimeters (1.2-5.0 inches) long, and 2-4 millimeters (0.08-0.1 inch) wide, four-sided when green, and flattened when dry.

The three endangered subspecies of *Erysimum menziesii* are distinguished as follows:

•*Erysimum menziesii* ssp. *menziesii* has flower stalks 3-9 millimeters (1.2-3.5 inches) tall, and the longest fruits are usually less than 8 centimeters (3.1 inches) long, whereas *E. menziesii* ssp. *eurekense* has flower stalks 9-15 millimeters (0.4-0.6 inch) tall, and the longest fruits are usually greater than 8 centimeters (3.1 inches) in length. The leaves of *E. menziesii* ssp. *menziesii* are generally lobed or irregularly toothed and the flowers are rich yellow.

•*Erysimum menziesii* ssp. *eurekense* is distinguished from the other subspecies by its more toothed (dentate) leaves, longer stems, and longer narrower fruits. Also, the leaves are less fleshy than those of *E. menziesii* ssp. *menziesii*, and the flowers of ssp. *eurekense* are light yellow.

•*Erysimum menziesii* ssp. *yadonii* differs from the other subspecies because it blooms in summer (June-August), whereas the other subspecies bloom in winter or spring. It tends to be perennial with a branched caudex. The flower petals are rich yellow.

2. Distribution

The species occurs on coastal sand dunes in Monterey County from Cypress Point north to Point Piños and in the Marina Dunes, in Mendocino County from Fort Bragg north to Ten Mile River, and in Humboldt County on the South Spit of Humboldt Bay and the Bay's North Spit (Samoa Peninsula) from its southern tip to The Nature Conservancy (TNC) Lanphere-Christensen Dunes Preserve (Figures 10 through 15). Tables 4, 5 and 6 provide data for the populations of each subspecies. In summary, *Erysimum menziesii* (three subspecies) is known from at least 16 extant populations with 33,300 individuals.

Erysimum menziesii ssp. *menziesii* is located in Monterey and Mendocino Counties. It occurs in seven isolated populations along the Monterey Peninsula from Point Piños to Cypress Point (Table 4). The Mendocino County populations range from Ten Mile River south to Fort Bragg. In Monterey County, populations exist in Pacific Grove, Asilomar State Park, Spyglass Hill, Point Piños Lighthouse, Signal Hill Road, Bird Rock Road (east of 17 Mile Drive) and Spanish Bay Golf Course. Populations at MacKerricher State Park in Mendocino County include hybrids with the common northern subspecies *E. m.* ssp. *concinnum*. Most of the populations are associated with MacKerricher State Park, except for the Pudding Creek population near Fort Bragg. The largest recorded population covers 577.1 hectares (1,426 acres) occurs at the Ten Mile River site in Mendocino County (Figure 13).

Erysimum menziesii ssp. *eurekense* occurs in Humboldt County from the coastal dunes of South Spit to TNC Lanphere-Christensen Dunes Preserve (Table 5). The subspecies *eurekensis* has five extant, recorded populations (NDDB 1996) in Humboldt County: Lanphere-Christensen Dunes Preserve, northwest of Mad River Slough, north of Manila

(Samoa Peninsula), U.S. Coast Guard Station (Samoa Peninsula), and the South Spit (Humboldt Bay). The subspecies has also been mapped as occurring in 12 stands in three subpopulations on the Samoa Peninsula.

Erysimum menziesii ssp. *yadonii* is restricted to four populations in the vicinity of the Marina Dunes, two at Marina State Beach, and the others at the RMC Lonestar Cement Company property approximately 0.8 kilometer (0.5 mile) south of the Salinas River Lagoon (Table 6 and Figure 15).

3. Habitat/Ecosystem

Erysimum menziesii is discontinuously distributed in the coastal foredune community of four disjunct dune systems: Humboldt Bay in Humboldt County, Ten Mile River in Mendocino County, and Monterey Bay and Monterey Peninsula in Monterey County. Subspecies *eurekense* has NDDB occurrences in coastal dunes and foredunes. Subspecies *menziesii* has NDDB occurrences in coastal strand, coastal dunes, central dune scrub, and northern dune scrub. Subspecies *yadonii* has NDDB occurrences in the following habitats: coastal dunes, foredunes, and coastal strand.

The habitats of the Monterey County populations differ from those of the northern California populations. Plants of *Erysimum menziesii* are generally distributed in clusters or patches (Botanica Northwest Associates 1992). In northern California, the species occurs in northern foredune or dune mat community, on the flanks or crests of dunes, open sand areas, sparsely vegetated dunes, and the borders of lupine scrub (Botanica Northwest Associates 1992). The species can tolerate some sand movement. The associated vegetation (sand-verbena - beach bursage series) community is composed of low-growing suffrutescent (obscurely shrubby) perennial and herbaceous native species (Sawyer and Keeler-Wolf 1995). Common species are beach sagewort (*Artemisia pycnocephala*), dune goldenrod (*Solidago spathulata*), coast buckwheat (*Eriogonum latifolium*), sand verbena, beach pea (*Lathyrus littoralis*) and seashore bluegrass (*Poa douglasii*).

In Monterey County, the species occurs on coastal strand, close to the high tide line, but largely protected from wave action. The species has high exposure to strong wind, salt spray, and occasional wave action from storms and high tides. The substrate is loose sand lacking in organic matter and minerals (Thomas Reid Associates 1987). What appears to be suitable habitat also occurs in geologically-recent bluff scrub and open, sparsely vegetated dunes, although a search conducted in this habitat was unsuccessful (Thomas Reid Associates 1987). Associated species along the Monterey Peninsula include beach primrose (*Camissonia cheiranthifolia*), beach-bur, sea rocket (*Cakile maritima*), beach knotweed (*Polygonum paronychia*), sand verbena and iceplant. Monterey County habitats of this species are relatively free of the invasive *Ammophila arenaria*.

4. Life History/Ecology

Erysimum menziesii is a biennial or short-lived perennial. The species reproduces by seed, and the seeds are dispersed by wind. Subspecies *yadonii* can be perennial, but will not fruit more than twice.

Erysimum menziesii germinates after the first rains in fall or early winter. The vegetative rosette stage of the life cycle can continue for up to eight years, and flowering may depend on rosette size (Pickart, *in litt.*, 1995).

The plant's pollinators are thought to be bees, bumblebees, butterflies, and moths (Price 1986). The species can set fertile seed through self pollination, so it reproduces both by selfing and through outcrossing (Price 1986). Subspecies *yadonii* is pollinated by a solitary bee species (*Emphoropsis miserabilis*) (Pickart 1988). The seeds are dispersed over time because they can remain attached after the seed pod splits open (Pickart 1988). The location and size of wallflower populations is dynamic because the plant occurs in a dynamic habitat. Seeds can be moved or washed away by strong winds, storm events or high tides, then be deposited in a new location in the coastal strand. Monterey Bay

19

populations are known to appear and disappear along the coastal strand (Thomas Reid Associates 1987)

A study by Professor Michael Mesler on Humboldt County populations concludes that the subspecies *eurekense* flowers for seven weeks (March to mid-April), average flower production is 29 flowers per plant, and an approximate average of two flowers are receptive to pollination per day (Pickart 1988)

5. Reasons for Listing

The species is threatened by invasion by non-native species, industrial and residential development, and trampling by recreational users such as pedestrians, equestrians, hang-gliders, and ORV users (U S Fish and Wildlife Service 1992) ORV activities still occur on private lands and present occasional problems on public lands Crucifer rust (*Albugo candida*), a fungus, may also have an impact on the species, but the degree of threat is currently unknown

In Humboldt County, subspecies *eurekense* is threatened by displacement from invasive non-native species, particularly European beach grass, iceplant, and yellow bush lupine (*Lupinus arboreus*) ORV impacts have been a major cause of habitat degradation in the past but management efforts have resulted in reduced threats from ORVs (Pickart, *in litt*. 1995) The displacement of subspecies *menziesii* by the invasive non-native iceplant is a threat to Monterey County populations and the populations north of Fort Bragg

In Monterey County, additional threats include browsing by deer (attempts to plant seedlings are successful only with caging), recreational uses (trampling), coastal erosion, sand mining activities, and the deposition of dredge material from adjacent water bodies

6. Conservation Measures

For known populations of *Erysimum menziesii* (Tables 4, 5, 6) on lands within the County of Monterey jurisdiction, Policy 2.3 of the North County Land Use Plan (LUP), relating to environmentally sensitive habitats, is applicable. The Monterey County LUP has established policies allowing for only resource-dependent uses within habitats known to support rare and endangered species. The LUP also recognizes dune habitat as environmentally sensitive, with or without rare and endangered species. Resource-dependent uses are allowed within environmentally sensitive habitat if they do not significantly disrupt habitat values. For proposed land divisions or developments, the County requires the protection of environmentally sensitive habitat through deed restrictions or dedications of permanent conservation easements.

The *Erysimum menziesii* population at The Nature Conservancy Lanphere-Christensen Dunes Preserve is managed by attempting to control exotic species [yellow bush-lupine and European beachgrass] (Pickart, *in litt.*, 1995). A study mandated by the Environmental Protection Agency (the Menzies Wallflower Research Program, funded by Louisiana-Pacific Corporation and Simpson Timber Company, administered by Humboldt State University and implemented cooperatively with TNC) has resulted in the development of habitat management measures that include removal of non-native plants, restoration, and habitat protection activities (Pickart, Millar and Duebendorfer 1990, Sawyer 1991). A study of the demographics and genetics of the subspecies was funded by the National Science Foundation and conducted by Michigan State University and TNC (Pickart, *in litt.*, 1995).

Humboldt County and the City of Eureka have several policies relating to the protection of sensitive resources. The Humboldt County Local Coastal Program prohibits vehicles above the wave slope except in the Samoa Dunes Recreational Area. There has been only partial enforcement of the local ordinance, and ORVs continue to impact the dune system (Pickart *in litt.*, 1995). The County has recently adopted a management plan for the north and south spits of Humboldt Bay. The plan designates certain areas for vehicular access on the beach and dunes as well as vehicle-free zones. This plan addresses access on public lands as well as access to/from adjacent BLM lands (Samoa and Manila dunes), private lands and the Lanphere-Christensen Dunes Preserve. The plan recommends management actions to restore degraded dune habitat areas, including removal of invasive, non-native plant species, fencing of rare plant habitat areas and limiting public access; however, the recommendations of the plan remain unfunded (Pickart *in litt.*, 1995). Recovery of these species will require the prevention of habitat loss and degradation through the implementation of these codes and ordinances.

The Eureka Dunes Protected Area, a 32-hectare (80-acre) site on the North Spit of Humboldt Bay (NDDB No. 4, Table 5), is owned by the City of Eureka and managed by the Center for Natural Management. The Eureka Dunes Habitat Mitigation Bank Phase II Enhancement Plan was funded by the State Coastal Conservancy and developed by TNC; however, no funding has been approved to implement the plan. Management has been limited to fencing sensitive habitat and protection from ORVs, while the site faces severe threats from exotic species' invasions.

The BLM has two small restoration projects to reduce the threat of lupine and beachgrass. The BLM has fenced 15 hectares (37 acres) of *Erysimum menziesii* habitat to protect it from ORV use on the Samoa Peninsula. However, because of inadequate funding, efforts to reduce the threat from invasive plants have been minimal (Pickart *in litt.* 1996). The BLM has managed to obtain some funding from outside sources that will require matching in kind services to provide for a season of weed removal on the Manila and Samoa sites (Jennifer Wheeler, BLM, Arcata, pers. com. 1997). Continued financial support for dune restoration will be essential to recover the species.

For populations of *Erysimum menziesii* (Tables 4, 5, 6) on lands in the Cities of Marina and Pacific Grove, implementation of the Cities' LUP should protect and restore native dune habitat and vegetation, and the habitat of rare and endangered species. The City's policies specify that primary habitat areas for sensitive species be protected and preserved. Development within secondary or support habitat areas is allowed, if it does not

22

significantly impact primary habitat areas Where development is proposed on parcels containing rare and endangered species, parcel owners are required to develop and execute a management plan that will protect the identified plant species

The City of Sand City's LUP specifies the intent to protect and preserve endangered species habitat Development of a habitat management and monitoring plan will be needed to assist in the long term protection and assistance in recovery for the species

Many comprehensive studies have been completed for The Marina Dunes of Monterey County including *The Marina Dunes Rare Plant Survey* (Zoger and Pavlik 1987) The California DPR conducted a population enhancement project at Marina and Asilomar State Beaches in Monterey County from July 1985 through July 1988 More than 5,000 seedlings were planted at Marina State Beach with an 80 percent success rate The populations on California DPR lands continue to be monitored The Pebble Beach Company has established endangered species management areas where Menzies wallflower establishment experiments are being monitored at Spanish Bay (Dorrell-Canepa, *in litt.*, 1995) California DPR also has a Management and Recovery Plan for Asilomar State Park Habitat protection measures such as boardwalks, fences, and signs have been implemented at Marina State Beach and Asilomar State Park to reduce recreational use impacts

The MacKerricher State Park Ten Mile Dunes Restoration Plan has been completed Also at MacKerricher State Park, *Erysimum menziesii* ssp *menziesii* habitat was revegetated after an archaeological dig

E. *GILIA TENUIFLORA* SSP. *ARENARIA* (Monterey gilia)

(Recovery Priority Number - 9)

1. Description

Gilia tenuiflora ssp *arenaria* (Monterey gilia or sand gilia) is State listed as threatened The species was first described and named *Gilia arenaria* in 1833 by George Bentham

23

based on specimens collected by David Douglas in the early 1800's. In 1943, Willis Linn Jepson reduced the plant to a variety of *G. tenuiflora*. After further taxonomic studies of the genus *Gilia* by Verne Grant and Alva Day Grant (1956), this plant was changed in rank to subspecies.

Gilia tenuiflora ssp. *arenaria* is a member of the phlox family (Polemoniaceae). The species is less than 1.7 decimeter (less than 6.7 inches) tall with a basal rosette of leaves (Figure 16). The central stem is erect with several other stems spreading out from the base which are covered with dense glandular hairs, sometimes giving a cobwebby appearance near the base (Grant and Grant 1956). This subspecies has funnel-shaped flowers with narrow petal lobes 2-4 millimeters (0.08-0.1 inch) wide and a narrow, purple throat 2-3 millimeters (0.08-0.1 inch) wide. Other characteristics that distinguish *G. tenuiflora* ssp. *arenaria* from the other three subspecies of *G. tenuiflora* include relatively large fruit capsules 5-6 millimeters (0.2-0.23 inch) long and stamens that are only slightly exerted.

Gilia tenuiflora ssp. *arenaria* locally intergrades with *G. tenuiflora* ssp. *tenuiflora* at the more inland areas of its distribution at Fort Ord (Dorrell-Canepa 1994).

2. Distribution

Gilia tenuiflora ssp. *arenaria* is distributed from Spanish Bay on the Monterey Peninsula north to Moss Landing. There are 15 known natural occurrences of this species, which are outlined in Table 7 and depicted on Figure 17. NDDB occurrence #11 is an experimental reintroduction, done as part of a dune mitigation project for a golf course development. Monterey Peninsula populations occur in the vicinity of Spanish Bay and Asilomar State Beach. Monterey Bay Dune populations occur from Moss Landing to Monterey, along coastal and inland dunes.

One of the largest known populations of *Gilia tenuiflora* ssp. *arenaria* was recently discovered at Fort Ord in 1993. Preliminary estimates indicate that as much as 60% of the total known individuals of this species may occur at Fort Ord. In summary, this supspecies is known from 15 extant populations with 110,400 individuals.

3. Habitat/Ecosystem

This species grows in sandy soils of dune scrub and maritime chaparral in the coastal dunes of Monterey County. This species is associated with dune scrub vegetation on transgressive sedimentary rocks (laid down during an ancient rise in sea level) and aeolian (wind-blown) deposits formed as sea level rose since the end of the last ice age (Barbour and Johnson 1988), occurring on rear dunes, near the dune summit in level areas, and on depressions or slopes in the dunes. Suitable habitat usually has a north, east or west aspect, and in wet years can occur on southern aspects. The species occurs at elevations no higher than 30 meters (100 feet). The substrate is sand with some soil development and litter accumulation (T. Reid and Associates 1987). The species favors sites with limited exposure to strong winds, salt spray and waves. It grows in open areas and wind-sheltered openings in the low-growing dune scrub vegetation and in areas where the sand has experienced some disturbance, such as along trails and roads. The species is usually tolerant of small amounts of drifting sand.

Low-growing dune scrub species associated with *Gilia tenuiflora* ssp. *arenaria* are silver beach lupine (*Lupinus chamissonis*), beach sagewort, mock heather, and coast buckwheat. Within the open, sparsely vegetated dunes, associated species include Monterey spineflower, dune knotweed, slender fescue (*Vulpia octoflora*), blue toadflax (*Linaria canadensis*), and popcorn-flower (*Plagiobothrys leiocarpa*).

4. Life History/Ecology

The species is thought to be primarily self-pollinating based on its stamens not protruding from the flower, no observations of pollinators, and very viable seed (Dorrell-Canepa, *in litt.*, 1995). Dorrell-Canepa (1994) has studied the ecology and growth of this species. She found that seeds, in the field, germinate from December to February, and fruit is set from the end of April to the end of May. The species appears to produce viable seed even at very small statures. Seeds are dispersed by wind throughout the dune openings; dispersal, however, is inhibited by dense stands of low-growing dune scrub.

Rabbit herbivory significantly affected the survival of young seedlings and adult plants. Mice or voles may also graze the species, but if the basal rosette is not entirely taken, the plant often recovers and sets seeds. In 1995 after heavy rains, herbivory was severe enough that many plants did not grow back (Dorrell-Canepa, *in litt.*, 1995).

5. Reason for Listing

Gilia tenuiflora ssp. *arenaria* is a Monterey County endemic species, restricted to the coastal dune scrub community of the Monterey Bay dunes and the Asilomar dunes of the Monterey Peninsula. Overall, the species is threatened by the degradation of suitable habitat from encroachment of invasive, non-native plant species, trampling by equestrians and pedestrians, as well as habitat removal for commercial and/or residential development. ORV activities have historically degraded habitat for the species.

The populations along the Monterey Bay dunes occur on both private and public land. The Naval Postgraduate School dunes population is threatened by trampling, and by the invasion of non-native species such as iceplant and ripgut brome (*Bromus diandrus*). The population on Tioga Avenue in Sand City is threatened by iceplant invasion, commercial activity, and proposals for residential development in the dunes (C. Roye, *in litt.*, 1996). The Salinas River State Beach population is threatened by invasion of iceplant and sand burial. The proximity of the Marina State Beach population to the parking and horse staging area makes it susceptible to trampling from pedestrians and equestrians. The population on RMC Lonestar Cement Co. property is threatened by sand mining. The inland dune populations are threatened by development and invasive, non-native species. Monterey Peninsula populations have been adversely affected by golf course development, non-native species, and trampling by pedestrians.

6. Conservation Measures

For known populations of *Gilia tenuiflora* ssp. *arenaria* (Table 7) on lands within the County of Monterey jurisdiction, Policy 2.3 of the North County Land Use Plan (LUP), relating to environmentally sensitive habitats, is applicable. The Monterey County LUP has established policies allowing for only resource-dependent uses within habitats known to support rare and endangered species. The LUP also recognizes dune habitat as environmentally sensitive, with or without listed species. Resource-dependent uses are allowed within environmentally sensitive habitat if they do not significantly disrupt habitat values. Land uses adjacent to locations of environmentally sensitive habitats should be compatible within the long-term maintenance of the resource. For proposed land divisions or developments, the County requires the protection of environmentally sensitive habitat through deed restrictions or dedications of permanent conservation easements. Where development has already occurred in areas supporting rare and endangered species, property owners should be contacted and are encouraged to voluntarily establish conservation easements, deed restrictions, or utilize other measures to provide protection for these species and their habitats.

For populations of *Gilia tenuiflora* ssp. *arenaria* (Table 7) on lands in the City of Marina, implementation of the City's LUP will protection and restore native dune habitat and vegetation, and the habitat of recognized rare and endangered species. The City's policies specify that primary habitat areas for sensitive species be protected and preserved. Development within secondary or support habitat areas is allowed, so long as it does not significantly impact primary habitat areas. Where development is proposed on parcels containing rare and endangered species, parcel owners are required to develop and execute a management plan that will protect the identified plant species. The City has recently completed the Coastal/Vernal Ponds Comprehensive Management Plan that identifies habitat for *Gilia tenuiflora* ssp. *arenaria* on lands owned by California DPR as part of Marina State Beach (Table 7). The plan recommends management actions to protect the rare plant habitat.

Sand City's LUP specifies the intent to protect and preserve endangered species habitat. The City will be developing several small Habitat Conservation Plans (HCPs) for federally-listed animals in part of its planning area. The HCPs will protect small areas of occupied habitat for *Chorizanthe pungens* var. *pungens* and *Gilia tenuiflora* ssp. *arenaria*.

The California DPR Resource Management Plans for the Monterey Bay area include measures to protect *Gilia tenuiflora* ssp. *arenaria* on State Beaches. Management actions prescribed by the plans are control of invasive, non-native species (non-native grasses and iceplant), mitigation and monitoring of human use impacts, alteration of visitor use patterns, and restoration of the dunes' native vegetation (Dept. of Parks and Rec. 1991). California DPR's restoration activities at Marina, Asilomar, and Salinas River State Beaches have included fencing and boardwalks to impede trampling by equestrians and hikers, control of invasive non-native plants, and vegetation restoration. Control of iceplant and stabilization of bare dunes with native vegetation has been undertaken by DPR since 1986 (C. Roye, *in litt.*, 1996).

The Navy is undertaking a dune restoration project that will restore native dunes and create native habitats in degraded areas at the Naval Postgraduate School. One of the main objectives of the restoration effort is to eradicate non-native plant species (e.g., iceplant and ripgut brome).

Base closure of Fort Ord has resulted in the transfer of management of some habitat for this species to the BLM, University of California, and the California DPR to be managed as open space. A *Gilia* restoration plan has been prepared by DPR to increase the Fort Ord coastal population by 14,000 to 18,000 individuals as part of an effort to restore 700 acres of coastal dune habitat (C. Roye, *in litt.* 1996).

Numerous research studies are ongoing or have been completed for *Gilia tenuiflora* ssp. *arenaria*. Dorrell-Canepa (1994) has studied the survival of seeds directly planted in dunes versus outplanting of greenhouse-raised seedlings. She found that greenhouse germination was almost 100 per cent, compared with 6-15 per cent of seed sown in dunes. She attributed the low field germination rates to variability in rain. Seeds have been collected for seed banking by the Rancho Santa Ana Botanic Garden and individuals conducting research or restoration. An experimental revegetation site at Spanish Bay golf course had an introduced population of this species (population number 11), which has since been extirpated.

F. *LAYIA CARNOSA* (Beach layia)

(Recovery Priority Number - 8)

1. Description

In 1841, Thomas Nuttall described this species as *Madaroglossa carnosa* based on specimens he collected in 1835. In 1843, John Torrey and Asa Gray transferred this species to the genus *Layia*. In 1892, Edward Greene changed the genus for this species to *Blepharipappus*. However, subsequent taxonomic considerations of this species agreed with Torrey and Gray (Munz and Keck 1959, Ferris 1960).

Layia carnosa is less than 15 centimeters (less than 6 inches) tall, succulent plant in the sunflower family (Asteraceae) (Figure 18). This plant can be unbranched to highly branched, spreading to more than 4 decimeters (16 inches) across. Several characteristics distinguish *L. carnosa* from other similar species: fleshy leaves, inconspicuous flower heads with short 2-4 millimeter (0.08-0.1 inch) white ray flowers and yellow disk flowers, and bristles around the top of the one-seeded dry fruit (achene).

2. Distribution

Until recent surveys, 17 occurrences of *Layia carnosa* had been found in seven dune systems from Santa Barbara County to Humboldt County. It is rather certain that some populations were extirpated or reduced in size before they could be surveyed. Today, this species is known from 19 extant populations with 300,000 individuals. Extant populations are shown in Figures 19 through 26, and summarized in Table 8. Five of the historical occurrences in San Francisco, Monterey and Humboldt counties are thought to be extirpated.

The largest populations are in Humboldt County. Three of the historic Humboldt County occurrences were on the Samoa Peninsula in the Humboldt Bay dune system, and two have been extirpated. The two extirpated populations were in the Little River area of Humboldt County; the northernmost population was probably removed when the river mouth naturally meandered north, eliminating the dune flora that was collected by Joseph Tracy in the early 20th century (occurrence number 14). The other population (occurrence number 15) was extirpated by construction of Highway 101 and invasion of non-native plant species in the 1960's. Other Humboldt populations include one associated with dunes at the mouth of McNutt Gulch, and one in dunes south of the Mattole River.

The Marin County populations occur in the dunes between Kehoe Beach Dunes and Point Reyes lighthouse at PRNS. Surveys by CNPS volunteers have recorded thirteen colonies along the dune complex at PRNS (Norris, *in litt.*, 1994).

The San Francisco Peninsula population occurred on the dune habitat in Golden Gate Park. Last collected from that area in 1904, the species is assumed by NDDB to be extirpated, probably because dunes were developed for Golden Gate Park and urbanization of San Francisco.

The Monterey Peninsula dune system had four occurrences, although the Point Piños site, the type locality, is thought to have been extirpated. After it had been reported to be extirpated, a population at Asilomar State Beach was rediscovered following the removal of iceplant. Additional occurrences have been discovered on neighboring private property (C. Roye, *in litt.*, 1996). Two beach layia populations exist on north Spyglass Hill and on the nearby Spyglass Hill dunes.

In April 1995, David Keil rediscovered a small population (80 plants) of *L. carnosa* on Vandenberg Air Force Base (VAFB), Santa Barbara County (David Keil, Curator, Robert Hoover Herbarium, pers. comm., 1995).

3. Habitat/Ecosystem

The species is restricted to coastal sand dunes, ranging in elevation from 0-30 meters (0-100 feet). In northern California, it occurs in the northern foredune community; in Monterey County, the species occurs in the central foredune community. It generally occurs in the foredune community, occupying sparsely vegetated open areas on semi-stabilized dunes. The foredune community experiences some drifting sand and has low-growing herbaceous and perennial native species. The species also occurs in open areas such as along trails and roads.

The cover of associated vegetation protects the species from sand dune movement and erosion. Associated species include coast buckwheat, beach pea (*Lathryus littoralis*), beach sagewort, dune bluegrass, dune goldenrod, sand verbena, and beach-bur.

4. Life History/Ecology

This winter annual germinates during the rainy season from fall to mid-winter, blooms in spring (April to June), and completes its life cycle before the dry season. It tends to grow in patches, and population numbers vary annually, both spatially and temporally (Botanica Northwest Associates 1992)

Little is known about the pollination ecology of *Layia carnosa* (Bruce Baldwin, Curator of the Jepson Herbarium, pers. comm., 1995)

5. Reasons for Listing

The threats to *Layia carnosa* are displacement by invasive, non-native vegetation, recreational uses such as ORV activities and pedestrians, and urban development (U S Fish and Wildlife Service 1992)

In Humboldt County, invasive non-native species that were used to stabilize dunes threaten this species, including yellow bush lupine, European beach grass, and iceplant Populations occurring on the Samoa Peninsula are also threatened by industrial development and ORV activity

The population that occurs within the King's Range National Conservation Preserve is managed by the BLM This population is threatened by ORV use and cattle grazing, but is not significantly disturbed by other recreational uses such as hiking The Mattole River population is on private land north of the river, and is threatened by cattle grazing and displacement by European beach grass

Marin County populations are affected by grazing and invasive non-native weeds

Monterey County populations have low numbers of individuals and are threatened by invasive non-native plants and encroaching development

The Santa Barbara County population is adjacent to a road at Vandenberg AFB The primary threats to this species are construction and road maintenance including installation

32

of a pipeline, road paving, and controlling vegetation by mowing and spraying with herbicides. The most recent survey recorded only 40 plants for this site resulting from approximately half the site being destroyed.

6. Conservation Measures

Layia carnosa, or beach layia, was State listed as endangered in 1991. For known populations of *Layia carnosa* (Table 8) on lands within Monterey County jurisdiction, Policy 2.3 of the North County Land Use Plan (LUP), relating to environmentally sensitive habitats, is applicable. The Monterey County LUP has established policies allowing for only resource-dependent uses within habitats known to support rare and endangered species. The LUP also recognizes dune habitat, as environmentally sensitive, with or without rare and endangered species. Resource-dependent uses are allowed in environmentally sensitive habitat if they do not significantly disrupt habitat values. Land uses adjacent to locations of environmentally sensitive habitats should be compatible within the long-term maintenance of the resource. For proposed land divisions or developments, the County requires the protection of environmentally sensitive habitat through deed restrictions or dedications of permanent conservation easements.

As part of the Marin Countywide Plan, conservation zones and subzones have been established for coastal areas that include populations of *Layia carnosa* (Table 8). Conservation zones are subject to a development review checklist that requires conservation measures, such as clustered development, dedicated open space easements and undeveloped greenbelt areas. The NPS has an ongoing effort to control exotic species. Continued efforts to manage non-native weeds will be essential for the protection of this species.

For populations of *Layia carnosa* on lands in Humboldt County (Table 8), the County and City of Eureka have several policies relating to the protection of sensitive resources. The Humboldt County Local Coastal Program prohibits vehicles above the wave slope except in the Samoa Dunes Recreational Area. The County has recently adopted a management plan for the north and south spits of Humboldt Bay. The north spit area supports *Erysimum menziesii* ssp. *eurekense* and *Layia carnosa*. The plan designates certain areas for vehicular access on the beach and dunes as well as vehicle-free zones. This plan addresses access on public lands as well as access to/from adjacent BLM lands, private lands and the Lanphere-Christensen Dunes Preserve. The plan recommends management to restore degraded dunes, including removal of invasive, non-native plant species, fencing of rare plant habitat and limiting public access.

In Humboldt County, TNC's Lanphere-Christensen Dunes Preserve is fenced and patrolled to control trespass by ORV users. TNC is also conducting native plant restoration activities on the North Spit of Humboldt Bay. Exotic plant removal in the dunes has resulted in colonization of the openings by *Layia carnosa*.

One population on the Samoa Peninsula occurs on land managed by the BLM and the City of Eureka. BLM manages the property and has fenced an area for the protection of *Layia carnosa*. Degradation of habitat continues on the adjacent City of Eureka land, although the City has zoned the site as a mitigation bank, protective measures have not been implemented. The BLM has obtained limited funding from outside sources that must be matched with, in-kind services to provide a season of weed removal on the Manila and Samoa sites (Jennifer Wheeler, BLM, Arcata, pers. com. 1997). Continued financial support for dune restoration will be needed to recover the species.

Various individuals have collected seed under the authority of a Memorandum of Agreement with the CDFG. The Pebble Beach Company collected achenes from the *Layia carnosa* population on its land, the achenes were sent to the State Endangered Plant Program for banking some years ago but the collecting and outplanting has ceased (B. Lopez, Pebble Beach Co., pers. comm. 1995). The Rancho Santa Ana Botanic Garden has collected *L. carnosa* for a seed bank, and Leslie Gottlieb, Professor of Genetics at the University of California, Davis, has collected achenes with the intended purpose of research and seed banking. According to Bruce Baldwin, Curator of the Jepson

Herbarium at UC Berkeley, Professor Gottlieb's research to date focuses on the study of gene duplications, and not seed banking.

G. *LUPINUS TIDESTROMII* (Tidestrom's lupine)

(Recovery Priority Number - 5)

1. Description

Lupinus tidestromii (Tidestrom's lupine) was described by Edward Greene in 1895 from an 1893 collection made by Ivar Tidestrom on the Monterey Peninsula. In 1938, Alice Eastwood described a similar lupine from Point Reyes (*L. layneae*). Philip Munz (1958) later recognized the Point Reyes plants as a variety of *L. tidestromii*, and called them *L. tidestromii* var. *layneae* to separate them from the Monterey Peninsula plants. The recent treatment by Rhonda Riggins and Teresa Sholars suggested that *L. tidestromii* exists as a single, variable species (Hickman 1993).

Lupinus tidestromii, a member of the pea family (Fabaceae), is a creeping perennial herb, 1-3 decimeters (4-12 inches) tall (Figure 27). The rhizomes (underground stems) of this plant help to bind the sand and stabilize the dunes. The above-ground parts are herbaceous, and the roots are bright yellow. The narrow leaves have 3-5 leaflets, each 5-20 millimeter (0.2-0.8 inch) long, and arranged in a fan shape. The stems and leaves have short hairs. The inflorescence stems are 4-8 centimeters (1.6-3.1 inches) long, and the whorls of flowers are blue to lavender. The fruits are pods containing 5-8 seeds with blackish spots. The prostrate habit, small leaflets 1.3-2 centimeters (0.5-0.8 inch) long, and dense hairs on the foliage distinguish *L. tidestromii* from other lupines occurring in the area.

2. Distribution

Lupinus tidestromii occurs from the Monterey Peninsula in Monterey County northward to the south bank of the Russian River near its mouth in Sonoma County (Figures 28 and 29). Clark and Fellers (1986) identified three populations of this species in PRNS, extending from Abbott's Lagoon to Point Reyes Test Station. Field studies by CNPS have expanded the known limits of the three populations to include seven colonies in the dunes of Point Reyes (Soost, *in litt.* 1996). The southernmost population is located at Pebble Beach in Monterey County. The NDDB occurrence number 11 is a transplanted population which was part of a dune created as mitigation for golf course construction. This species is known from 19 extant populations with 433 individuals.

3. Habitat/Ecosystem

Lupinus tidestromii occurs on partially stabilized coastal dunes up to about 8 meters (25 feet) high. Several occurrences on the Monterey Peninsula are on remnant dunes in the yards of private residences. It occurs in the mild maritime climate of the central California coast and grows in coastal dune communities in association with Menzies' wallflower, sand gilia, beach sagewort, sand verbena, and mock heather.

4. Life History/Ecology

The life history of *Lupinus tidestromii* is largely unknown or the information is unpublished. Flowering occurs from May through June. *L. tidestromii* is probably pollinated by bees. When the seed pods are sufficiently dry, they open suddenly and the seeds fly out. Seeds of *Lupinus* are generally long lived and the seed coat must be scarified to induce germination. The active dune habitat provides opportunities to bury the seed and etch the seed coat providing the necessary treatment for germination. The species grows in active dune ecosystems and, with its prostrate habit, can survive partial burial providing local dune stabilization.

36

5. Reasons for Listing

The major threats to *Lupinus tidestromii* included invasion by non-native plants, such as iceplant and European beachgrass and loss of habitat due to development, trampling by hikers and equestrians, and livestock grazing. Two populations on the Monterey Peninsula were eliminated by construction of a golf course. Other populations on privately owned sites in Monterey are potentially threatened by residential and recreational development. The populations in Asilomar State Park and PRNS were subject to trampling by hikers. Additionally, cattle grazing on the dune system near Dillon Beach presents a potential threat of trampling to this species.

6. Conservation Measures

For known populations of *Lupinus tidestromii* (Table 9) on lands within Monterey County jurisdiction, Policy 2.3 of the North County Land Use Plan (LUP), relating to environmentally sensitive habitats, is applicable. The Monterey County LUP has established policies allowing for only resource-dependent uses within habitats known to support rare and endangered species. The LUP also recognizes dune habitat, with or without rare and endangered species, as environmentally sensitive. Resource-dependent uses are allowed within environmentally sensitive habitat if they do not significantly disrupt habitat values. Land uses next to locations of environmentally sensitive habitats should be compatible with the long-term maintenance of the resource. For proposed land divisions or developments, the County requires the protection of environmentally sensitive habitat through deed restrictions or dedications of permanent conservation easements.

As part of the Marin County Wide Plan, conservation zones and subzones have been established for coastal areas that include habitat for *Lupinus tidestromii* (Table 9). Currently, only one population is known to occur within the jurisdiction of the County and it is reported to have been affected by camping and cattle grazing (Soost, *in litt.*, 1996).

Recovery will depend on effective management of the populations and habitats in Point Reyes National Seashore

Asilomar State Beach has developed a management plan for dune enhancement. This plan proposes restoration of native dune vegetation, control of invasive, non-native species, monitoring and mitigation of human-use impacts, and changing visitor use patterns. Boardwalks have been constructed to direct visitors away from sensitive dune areas and allow beach access while minimizing trampling of dune vegetation (C. Roye, *in litt.*, 1996).

The Pebble Beach Company set aside an 8.1 hectare (20 acres) preserve as mitigation for loss of sensitive species during the construction of the Spanish Bay Golf Course. *Lupinus tidestromii* was one of the species transplanted to the site in 1987, and monitoring is continuing.

H. MYRTLE'S SILVERSPOT BUTTERFLY (*Speyeria zerene myrtleae*)

(Recovery Priority Number - 9)

1. Description

The Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*) is a member of the brush-footed family (Nymphalidae). It was recognized as a subspecies in 1945 by dos Passos and Grey (1945), who described specimens collected by W.F. Breeze in 1919 from San Mateo County. Butterflies in the genus *Speyeria* are commonly known as silverspots or fritillaries.

Myrtle's silverspot is a medium-sized butterfly with a wingspan averaging 55-60 millimeters (2.1-2.3 inches) (Figure 30). The upper sides of the fore and hind wing surfaces are golden brown to fulvous with many conspicuous black spots, lines, and other markings (maculations), and a greenish basal suffusion. The undersides are light tan, reddish brown, and brown with black lines and distinctive silver spots and black spots. The basal area of the wings and the body are densely covered with hairs (Howe 1975).

Overall, Myrtle's silverspot is very similar in size and appearance to Behren's silverspot (*S. z. behrensii*), which is proposed for federally endangered status. However, Myrtle's silverspot can be distinguished by its discal area (center of the underside of the hind wing) that is reddish-brown with yellowish-green overscaling, and its submarginal band that is bright yellow (Howe 1975). These features are in contrast to *S. z. behrensii*, whose band is dull olive and not as well-developed. Figure 30 shows a black-and-white rendering of a color illustration of Myrtle's silverspot which was published in Howe (1975). Scott (1986) also published color illustrations of this species.

Immature life stages of Myrtle's silverspot have not been formally described, but are assumed to be similar to those of other *Speyeria* taxa. Larvae (caterpillars) are dark colored with many sharp, branched spines on their back.

2. Distribution

Myrtle's silverspot occupies the southern-most range of all the coastal Zerene silverspot butterflies. Historically, Myrtle's silverspot was found from coastal San Mateo County (Pacifica and San Mateo areas) north to Jenner Beach in Sonoma County. Historical records of Myrtle's silverspot are known from Inverness and Point Reyes Station in Marin County, and in Sonoma County from Bodega Bay, the vicinity of Stewart's Point, Anapolis Road near Sea Ranch, Coleman Valley Road, Jenner, Portuguese Beach, Timber Cove Road, Bloomfield (the most inland known site), and Valley Ford (information from the "BUGGY" database, a database maintained by Dick Arnold, Ph.D., Entomological Consulting Services, Ltd.). Butterflies that are intermediate in appearance between the Myrtle's and Behren's subspecies have been observed north of Jenner and south of Anchor Bay in Mendocino County (Launer *et al.* 1992). By the late 1970s, populations of Myrtle's silverspot south of the Golden Gate Bridge were believed to be extinct and extant populations were known only from Marin County at the PRNS. In 1990, this subspecies was discovered at a new site in Marin County (Arnold 1990), north of Estero de San Antonio on property proposed for a golf course resort, the Marin Coast Golf Ranch (MCGR). This discovery induced more surveys of the current and historical range of Myrtle's silverspot butterfly.

The Center for Conservation Biology (CCB) at Stanford University undertook field studies beginning in 1991 through 1993, the results of this study were published in 1994 in a back-dated journal volume (Launer *et al.* 1992). Myrtle's silverspot were observed at several sites from 1991-93, including the proposed MCGR site, and the hills between Dillon Beach and Estero de San Antonio in Marin County, and Estero Lane in Sonoma County. At PRNS, Myrtle's silverspot butterflies were found on Tomales Point in the tule elk range and throughout the area west of Drakes Estero and Schooner Bay (Launer *et al.* 1992). No other sites in the region are known to currently support Myrtle's silverspot, however, private lands in the area appear to have suitable habitat, but have not been censused (Launer *et al.* 1992). Extant populations of Myrtle's silverspot are shown in Figure 31, and population data are summarized in Table 10.

The CCB studies, cited above, included a mark/recapture program to estimate the number of butterflies. At the MCGR site, the number of Myrtle's silverspots was estimated to be between 2,500 and 5,000 adults in 1991. At the mark/recapture study site at North Beach in PRNS, between 200 and 600 butterflies were estimated to be using the site in 1993. However, based on all observations and studies, it was suggested that the butterflies at North Beach were only part of an extended population of Myrtle's silverspot in central Point Reyes. The total number of this population was estimated at less than 5,000 individuals in 1993 (Launer *et al.* 1992). The Tomales Point population is believed to be much smaller, with only several hundred butterflies (Launer *et al.* 1992). In summary, this butterfly is known from three populations with a total of fewer than 10,000 individuals. Population numbers can be expected to fluctuate drastically (see the section below).

3. Habitat/Ecosystem

Myrtle's silverspot inhabits coastal dunes, coastal prairie, and coastal scrub in Sonoma and Marin Counties. They occur at elevations ranging from sea level to 300 meters (1,000 feet), and as far as 5 kilometers (3 miles) inland (Launer *et al.* 1992). This species prefers areas protected from onshore winds, but can be observed in exposed areas when winds are calm. Temperatures in this region are moderated by fog, which keeps summers relatively cool and winters relatively warm. The fog also provides moisture to vegetation, in addition to the ample winter rains.

Critical factors in the distribution of the Myrtle's silverspot include presence of the larval host plant, *Viola adunca* (western dog violet), and availability of nectar sources for adults. Much of the coastal prairie in this species' range has been grazed for over a century, and is now characterized by a mixture of non-native annuals and forbs and native prairie plants. In the upland grasslands, this butterfly has been observed obtaining nectar from non-native species such as bull thistle (*Cirsium vulgare*) (Arnold 1990) and Italian thistle (*Carduus pycnocephalus*) (Murphy and Launer 1991). In dune scrub habitat, these butterflies seek nectar from several native species such as gum plant (*Grindelia* sp.), western pennyroyal (*Monardella undulata*), yellow sand verbena, and seaside daisy (*Erigeron glaucus*). Myrtle's silverspot does not use iceplant flowers for nectar (Launer *et al.* 1992).

4. Life History/Ecology

During the summer flight season, females of Myrtle's silverspot lay their eggs on or near dried leaves and stems of the presumed larval foodplant, *Viola adunca*. Within a few weeks after the eggs are laid, the larvae or caterpillars hatch. These caterpillars, which are less than 5 millimeters (0.2 inches) long, crawl a short distance into the surrounding foliage or litter, and spin a silk pad on which they spend the fall and winter. The winter period of inactivity is a physiological resting state called diapause, during which no feeding occurs. At the end of diapause in the following spring, the caterpillar begins feeding on

Viola adunca. This feeding stage of the life history lasts from 7-10 weeks, when the larvae form their pupal chamber out of leaves spun together with silk. The adult butterfly emerges from the pupa after about two weeks. Emergence typically occurs from mid-June to mid-July. The timing of adult emergence is probably related to climatological events, such as photoperiod and degree-days, which may result in annual differences of the population's peak emergence by as much as a few weeks.

Adult Myrtle's silverspot were observed to have a two- to three-month flight period, ranging from mid-June to early October (Launer *et al.* 1992). Butterfly activity is closely tied to weather conditions; they are active during calm weather and inactive during windy periods. Populations of *Speyeria* butterflies are known to exhibit vast fluctuations in numbers of individuals, appearing at times to be virtually on the brink of extinction, and then rebounding to substantially higher numbers the following year. The reasons for this type of population structure are not well understood.

5. Reasons for Listing

The Myrtle's silverspot has been extirpated from an estimated 33 per cent of its historical range by urban development, invasive non-native vegetation, livestock grazing, and other human influences. The coastal San Mateo population was last documented in 1919, and was probably extirpated by loss of habitat to urbanization and agriculture. One population in Marin County has been threatened by the proposed development of a golf resort.

Overcollection is a threat to Myrtle's silverspot. Although collectors generally do not adversely affect the healthy, well-dispersed populations of many butterfly species, a number of rare species, highly valued by collectors, are vulnerable to extirpation from collecting (C.D. Nagano and J. Mendoza, USFWS, pers. obs. 1992-1994). Collection of butterfly species that exist in small colonies or repeated handling and marking (particularly of females and in years of low abundance) can seriously damage the populations through loss of individuals and genetic variability (Singer and Wedlake 1981, Gall 1984, Murphy

1988) Collection of females dispersing from a colony also can reduce the probability that new colonies will be founded. Butterfly collectors pose a threat because they may be unable to recognize when they are depleting colonies below the thresholds of survival and recovery, especially when they lack appropriate biological training or the area is visited for a short period of time (Collins and Morris 1985). Furthermore, collectors who take every specimen they can find on successive days could easily eliminate populations of some species in just a few years, as they reportedly have with Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*).

Overgrazing of properties within the range of Myrtle's silverspot may have reduced the abundance of native nectar sources, and could be contributing to the regional decline of this species (Launer *et al.* 1992). An abundant supply of nectar plants is needed by butterflies, because the amount of nectar consumed by females influences the number of eggs produced. The reduction in native nectar sources may have been offset, at least partially, by the silverspot's use of non-native thistles as nectar sources. Grazing disturbance eliminates the native plant species and disturbs the site, allowing the establishment of invasive non-native weedy plant species. One such weed is the invasive, non-native iceplant, a competitive threat to several native plant species which provide this butterfly with nectar. This plant and other non-native grasses and forbs have undoubtedly displaced larval and adult foodplants of the silverspot and contributed to overall degradation of habitat quality.

6. Conservation Measures

Suggested conservation measures for Myrtle's silverspot include identifying and establishing grazing regimes that would benefit this species' larval host plants and adult nectar sources, controlling iceplant, and restoring dune habitat. Two populations are protected at Point Reyes National Seashore, however, there is no management plan for the butterfly. The habitat north of Point Reyes in the County of Marin has been established as an Agricultural Land Trust along a 25-mile stretch of coast where the butterfly occurs.

43

however, grazing pressures have eliminated native nectar resources (A. Launer, *in litt.*, 1995).

I. STRATEGY OF RECOVERY

The common threat to all of the species in this plan is the displacement and habitat alteration caused by non-native plant species.

The plant species will be recovered by restoring and protecting dune habitats on which they (and when applicable, their pollinators) depend. Assuring long-term protection of public and privately-owned habitat is essential. Carrying out existing land-use plans will be very important, and habitat conservation plans, as provided for listed animals by the Endangered Species Act, are likely to contribute to long-term habitat protection. Once land is protected, the primary means to accomplish recovery is through an aggressive program to control non-native invasive plant species. Sound, peer reviewed site-specific management plans will be necessary. Long-term commitment of resources by public agencies to management, including weed control, will be essential to the long-term conservation of these species. A certain amount of trial and error will be needed to ensure that management procedures work as intended (the technical term for this approach is "adaptive management"). Artificial creation of new populations is recommended only as a last resort, when research and experimental management show that natural processes including colonization are not sufficient to achieve recovery.

The recovery strategy for the Myrtle's silverspot butterfly is to protect, manage and secure the three known population sites. Monitoring will be required to determine if butterfly populations (numbers) are relatively stable and the sites adequately protected, so the Myrtle's silverspot may be considered for de-listing. The possibility of introducing the butterfly into the region south of San Francisco where it was extirpated might contribute to recovery, and should be explored.

Table 1. Summary of Population Data for *Chorizanthe howellii*

Population[1] and Location	Approximate Size (hectares)[2]	Number of Individuals	Ownership
NDDB No. 1 MacKerricher State Park, Mendocino County	50.6 ha (125.0 acres)	20,000 (1988) 20 (1993)	MacKerricher State Park, California Department of Parks and Recreation (DPR)
NDDB No. 3 Ten Mile Dunes, Mendocino County	-	100 (1983)	MacKerricher State Park (DPR)
NDDB No. 4 Inglenook, Mendocino County	-	100 (1983) 3,150+ (1988)	MacKerricher State Park (DPR)
NDDB No. 6 Ten Mile Dunes, Mendocino County	-	350 (1988)	MacKerricher State Park (DPR)
NDDB No. 7 Ten Mile Dunes, Mendocino County	-	210 (1988)	MacKerricher State Park (DPR), Private
NDDB No. 9 South of Fort Bragg	-	- (1958)	Unknown
NDDB No. 10 Grange Hall, Mendocino County	-	-	Private
TOTAL	**50.6 ha.+ (125.0 acres)**	**23,700**	

[1] Populations are identified by occurrence numbers listed in the 1997 California Department of Fish and Game (CDFG) Natural Diversity Data Base (NDDB)

[2] A dash (-) indicates no data are available at this time

Table 2. Summary of Population Data for *Chorizanthe pungens* var. *pungens*

Population[1] and Location	Approximate Size (hectares)[2]	Number of Individuals	Ownership
NDDB No. 4 Point Piños, Monterey County	62.3 ha (153.9 acres)	Herbarium sheet (no date)	Unknown
NDDB No. 5 Cypress Point, Monterey County	-	Herbarium sheet (1940)	Unknown
NDDB No. 6 Arroyo Seco, Monterey County	-	Herbarium sheet (1920)	Unknown
NDDB No. 7 Manzanita Park, Monterey County	12.1 ha (29.9 acres)	Herbarium sheet (1989)	County of Monterey
NDDB No. 8 Naval Postgraduate School, Monterey County	11.3 ha (27.9 acres)	- (1992)	U.S. Department of Defense (DOD)
NDDB No. 10 Pacific Grove, Monterey County	-	Herbarium sheet (1908)	Unknown
NDDB No. 11 Gigling, Monterey County	-	Herbarium sheet (1919)	Unknown
NDDB No. 12 Pajaro River, Monterey County	-	Herbarium sheet (1936)	Unknown
NDDB No. 13 Seaside, Monterey County	-	Herbarium sheet (1950)	Unknown
NDDB No. 14 Watsonville Junction, Monterey County	-	Herbarium sheet (1936)	Unknown
NDDB No. 16 Marina Dunes, Monterey County	4.5 ha (11.1 acres)	Map (1987)	Private
NDDB No. 17 Marina Dunes, Monterey County	-	Map 1987)	Private

Population[1] and Location	Approximate Size (hectares)[2]	Number of Individuals	Ownership
NDDB No. 18 Marina Dunes, Monterey County	5.7 ha. (14.1 acres)	Map (1987)	Private
NDDB No. 19 Manresa State Beach, Santa Cruz County	-	50 (1986)	DPR
NDDB No. 20 Castroville, Monterey County	-	Herbarium sheet (1929)	Unknown
NDDB No. 21 Moss Landing, Monterey County	23.5 ha. (58.1 acres)	Herbarium sheet (1952)	Unknown
NDDB No. 22 Fort Ord, Monterey County	-	Herbarium sheet (1988)	DOD
NDDB No. 23 Fort Ord, Monterey County	-	Herbarium sheet (1988)	DOD
NDDB No. 24 Del Rey Oaks, Monterey County	-	Herbarium sheet (1988)	Unknown
NDDB No. 25 Marina Dunes, Monterey County	-	Map (1987)	Private
NDDB No. 26 San Simeon, San Luis Obispo County	-	- (1842)	Unknown
Fort Ord	4224 hectares (10, 456 acres)	14,000,000± (1992)	DOD
Sunset State Beach, Santa Cruz County	10.0 hectares (24.7 acres)	-	DPR
Day Valley, Santa Cruz County	<0.1 hectares (<0.25 acre)	100-1,000 (1994)	Private
Freedom Blvd., Santa Cruz County	2.0 hectares (4.9 acres)	1,000+ (1994)	Private

Population[1] and Location	Approximate Size (hectares)[2]	Number of Individuals	Ownership
East Bellmar Drive, Santa Cruz County	0.1 ha (0.25 acre)	10,000 (1994)	Private
Cox Road, Santa Cruz County	<0.1 ha (0.25 acre)	100 (1994)	Private
Marina State Beach, Monterey County	10.0 ha (24.7 acres)	1,000+ (1994)	Marina State Beach (DPR)
TOTAL	**6402 ha.+ (26,837 acres+)**	**14,012,000+**	

[1] Populations are identified by occurrence numbers listed in the 1994 CDFG NDDB

[2] A dash (-) indicates no data are available at this time

Table 3. Summary of Population Data for *Chorizanthe valida*

Population[1] and Location	Approximate Size (hectares)[2]	Number of Individuals	Ownership
NDDB No. 1 Russian Colony	-	- (1877)	-
NDDB No. 2 Lunny Pasture/ Abbott's Lagoon, Marin County	1.7 ha.[3] (4.2 acres)	100 (1980) 2,000 (1984) 1,000 (1986) 2,500 (1988) 3,000 (1989) 2,000 (1990) 25,000 (1991) 27,000 (1992) 30,000 (1993) 7570 (1994)	Point Reyes National Seashore (PRNS), National Park Service (NPS)
NDDB No. 4 Sebastopol, Sonoma County	-	-	-
NDDB No. 5 Petaluma, Sonoma County	-	Herbarium label (no date)	-
TOTAL	**1.7 ha.[3] (4.2 acres)**	**30,000+**	

[1] Populations are identified by occurrence numbers listed in the 1994 CDFG NDDB

[2] A dash (-) indicates no data are available at this time

Table 4. Summary of Population Data for *Erysimum menziesii* ssp. *menziesii*

Population[1] and Location	Approximate Size (hectares)[2]	Number of Individuals	Ownership
NDDB No. 1 Pacific Grove, Monterey County	1.9 ha (4.7 acres)	<100 (1987) 0 (1991)	U.S. Coast Guard, City lease
NDDB No. 4 Ten Mile River, Mendocino County	577.1 ha (1,425.9 acres)	Large discontinuous pop. (1993)	Private, (MacKerricher State Park (DPR)
NDDB No. 5 Pudding Creek, Mendocino County	3.7 ha (9.1 acres)	<50 (1982) 100+ (1994)	Private
NDDB No. 7 Asilomar State Park, Monterey County	4.9 ha (11.6 acres)	<100 (1982)	Asilomar State Park (DPR)
NDDB No. 8 Spyglass Hill, Monterey County	-	<100 (1987)	Private
NDDB No. 35 Point Piños Lighthouse, Monterey County	-	<20 (1987)	Private
NDDB No. 37 Signal Hill Rd., Monterey County	-	-	Private
NDDB No. 38 Bird Rock Rd., Monterey County	-	<10 (1988)	Private
NDDB No. 39 Virgin Creek, Sonoma County	2.8 ha (6.9 acres)	>100 (1990)	MacKerricher State Park (DPR)
NDDB No. 40 Spanish Bay Golf Course, Monterey County	7.7 ha (19.0 acres)	Unsuccessful outplanting (1987)	Private: restoration site in golf course (Pebble Beach)
TOTAL	**598.1 ha.+ (1,477.9 acres+)**	**600+**	

[1] Populations are identified by occurrence numbers listed in the 1994 CDFG NDDB.

[2] A dash (-) indicates no data are available at this time.

Table 5. Summary of Population Data for *Erysimum menziesii* ssp. *eurekense*

Population[1] and Location	**Approximate Size (hectares)[2]**	**Number of Individuals**	**Ownership**
NDDB No. 1 Lanphere-Christensen Dunes Preserve, Humboldt County	20.3 ha (50.2 acres)	>6,000 (1988)	The Nature Conservancy (TNC)
NDDB No. 2 NW of Mad River Slough, Humboldt County	18.5 ha (45.7 acres)	500 (1988)	Bureau of Land Management (BLM), Louisiana Pacific, Private
NDDB No. 3 North of Manila, Samoa Peninsula, Humboldt County	5.0 ha (12.4 acres)	136 (1988)	Private
NDDB No. 4 Coast Guard Station, Samoa Peninsula, Humboldt County	262.9 ha (649.6 acres)	12,000 (1988)	BLM, City of Eureka, Private, U.S. Coast Guard
NDDB No. 5 South Spit, Humboldt Bay, Humboldt County	-	178 (1991)	Private (Texaco, Pacific Lumber Company)
TOTAL	**904.8 ha.+** **(2,235.7 acres+)**	**18,800**	

[1] Populations are identified by occurrence numbers listed in the 1994 CDFG NDDB.

[2] A dash (-) indicates no data are available at this time.

Table 6. Summary of Population Data for *Erysimum menziesii* ssp. *yadonii*

Population[1] and Location	**Approximate Size (hectares)[2]**	**Number of Individuals**	**Ownership**
NDDB No. 1 South of Salinas River, Monterey County	10.0 ha (24.7 acres)	possibly extirpated (1980)	-
NDDB No. 2 West of Lapis Siding, Monterey County	8.9 ha (21.9 acres)	13,900 (1987)	Private (RMC Lonestar Cement Company)
NDDB No. 3 Lonestar, Monterey County	-	(1982)	Private (RMC Lonestar Cement Company)
NDDB No. 4 Marina Dunes, Monterey County	-	500 (1991)	Unknown
NDDB No. 5 Marina State Beach, Reservation Road, Monterey County	10.0 ha (24.7 acres)	300 (1985)	DPR
NDDB No. 6 Marina State Beach, near Fort Ord, Monterey County	2.2 ha (5.4 acres)	8,000 (1986) 5,000 (1987) propagated population	DPR
TOTAL	**31.1 ha.+ (76.9 acres+)**	**14,700**	

[1] Populations are identified by occurrence numbers listed in the 1994 CDFG NDDB

[2] A dash (-) indicates no data are available at this time

Table 7. Summary of Population Data for *Gilia tenuiflora* ssp. *arenaria*

Population[1] and Location	Approximate Size (hectares)[2]	Number of Individuals	Ownership
NDDB No. 1 Spanish Bay Golf Course, Monterey County	8.0 ha (19.8 acres)	700-1,000 (1993)	Pebble Beach Company
NDDB No. 2 Naval Postgraduate School Dunes, City of Monterey	11.0 ha (27.2 acres)	1498 (1991) 1950 (1986) 8-13,000 (1993)	DOD, U.S. Navy
NDDB No. 3 Tioga Ave., City of Sand City	-	10,000 (1986) 5,000 (1987) 25,000 (1993)	Private
NDDB No. 4 Marina State Beach, Monterey County	10.0 ha (24.7 acres)	10,000 (1985) 300 (1986) 20 (1992) 325 (1993)	DPR
NDDB No. 5 Salinas River State Beach, Monterey County	10.0 ha (24.7 acres)	<10,000 (1985) 10,000 (1986) 1,665 (1987) 13,500 (1993)	DPR
NDDB No. 6 Spanish Bay Golf Course, Monterey County	-	Extirpated	Pebble Beach Company
NDDB No. 10 Del Rey Oaks, Monterey County	-	50 (1985)	Unknown
NDDB No. 11 transplanted population, Spanish Bay Golf Course, Monterey County	-	Extirpated	Pebble Beach Company
NDDB No. 12 Fort Ord, Monterey County	-	Map (1992)	DOD
NDDB No. 13-19 Fort Ord, Monterey County	-	Map (1992)	DOD
NDDB No. 20 Fort Ord, Monterey County	(420 acres)	42,600 (1993)	DOD
NDDB No. 21 Fort Ord, Monterey County	(9.4 acres)	515 (1993)	DOD

Table 7. Summary of Population Data for *Gilia tenuiflora* ssp. *arenaria* (Cont'd.)

Population[1] and Location	Approximate Size (hectares)[2]	Number of Individuals	Ownership
NDDB No. 22 Fort Ord, Monterey County	-	20 (1992)	DOD
NDDB No. 23 Reservation/Seaside Monterey County	0.01 ha (0.02 acre)	500 (1994)	Private
NDDB No. 24-26 Marina/Reservation Rd Monterey County	-	Report (1987)	-
NDDB No. 27 Marina Dunes	5.9 ha (14.8 acres)	2,295 (1987)	Private
NDDB No. 28 Marina, Monterey County	-	Report (1987)	-
NDDB No. 29 Mulligan Hill, Salinas River Lagoon, Monterey County	4.0 ha (9.9 acres)	3,000-5,000 (1993)	Private (Scattini and Sons)
NDDB No. 30 Watertower Hill, Moss Landing, Monterey County	4.0 ha (9.9 acres)	400-600 (1993)	Private
NDDB No. 31 Fort Ord/Imjin, Monterey County	13.7 ha (34.1 acres)	698 (1993)	DOD
NDDB No. 32 Asilomar State Park, Monterey County	5.0 ha (12.4 acres)	550 (1993)	DPR
Sand Dollar Shopping Center, Monterey County	-	<200 (1994) (experimental transplant area)	Private conservation easement
TOTAL	**1,833.6 ha.+ (4,531.2 acres+)**	**110,435+**	

[1] Populations are identified by occurrence numbers listed in the 1994 CDFG NDDB

[2] A dash (-) indicates no data are available at this time

Table 8. Summary of Population Data for *Layia carnosa*

Population[1] and Location	Approximate Size (hectares)[2]	Number of Individuals	Ownership
NDDB No. 1 Santa Barbara County	-	extirpated?	DOD, Vandenberg Air Force Base
NDDB No. 2 North Spyglass Hill, Monterey County	-	extirpated? 0 (1984) 0 (1989)	Private (Pebble Beach Company)
NDDB No. 3 Spyglass Hill Dunes, Monterey County	-	<100 (1987)	Private (Pebble Beach company)
NDDB No. 4 Point Piños, Monterey County	-	Type location (1912) 0 (1987)	DOT
NDDB No. 5 Pico Ave., Pacific Grove, Monterey County	-	5 (1994)	Private
NDDB No. 7 (PRNS#10,13) Kehoe Beach Dunes, Marin County	-	100+ (1987) 125 (1990)	PRNS (NPS)
NDDB No. 8 (PRNS# 2) Abbott's Lagoon, Marin County	13.13 ha (32.5 acres)	118 (1988) 1,500 (1989) 3,700 (1990)	PRNS (NPS)
NDDB No. 9 McNutt Gulch, Humboldt County	20.6 ha (50.9 acres)	>500 (1987)	Private
NDDB No. 10 Mattole River Mouth, Humboldt County	10.9 ha (26.9 acres)	>1,000 (1987)	BLM, Arcata Resource Area
NDDB No. 11 Lanphere-Christensen Dunes Preserve, Humboldt County	58.3 ha (144.1 acres)	30,000+ (1991)	TNC, Private
NDDB No. 12 Samoa Peninsula, Humboldt County	196.3 ha (485.1 acres)	30,000+ (1991)	BLM, City of Eureka, DOD, U.S. Coast Guard
NDDB No. 14 Mouth of Mad River, Humboldt County	-	- 1963 0 (1987)	Private

Table 8. Summary of Population Data for *Layia carnosa* (Cont'd.)

Population[1] and Location	Approximate Size (hectares)[2]	Number of Individuals	Ownership
NDDB No. 15 Little River State Beach, Humboldt County	-	- (1937) 0 (1987)	DPR
NDDB No. 17 Manila, Samoa Peninsula, Humboldt County	109.7 ha (271.1 acres)	42,000 (1991) 200,000 (1993)	PVT, BLM
NDDB No. 19 (PRNS # 6) Marin County	8.1 ha (20.1 acres)	40 (1988) more (1989)	PRNS (NPS)
NDDB No. 20 Marin County	2.1 ha (5.3 acres)	99 (1989)	PRNS (NPS)
NDDB No. 21 (PRNS# 5), Marin County	12.8 ha (31.8 acres)	12 (1988) few (1992)	PRNS (NPS)
NDDB No. 22 (PRNS#2), Marin County	5.5 ha (13.7 acres)	78 (1988) 2,290 (1989)	PRNS (NPS)
NDDB No. 23, (PRNS#8) Marin County	-	12 (1989)	PRNS (NPS)
NDDB No. 24, (PRNS#4) Marin County	-	36 (1988)	PRNS (NPS)
NDDB No. 25, (PRNS#1) **(PRNS# 7)** Marin County **(PRNS#12)**	- - -	#1 2,140 (1988) #7 790 (1984) #12 200 (1991)	PRNS (NPS)
NDDB No. 26, (PRNS #11) Marin County	-	107 (1991)	PRNS (NPS)
NDDB No. 27 South Spit, Humboldt County	103.1 ha (255.4 acres)	20,000	Private-Simpson Timber, Texaco
NDDB No. 28 Vandenberg AFB, Santa Barbara County	0.1 ha (0.25 acre)	80 (1995)	DOD, U.S. Air Force
TOTAL	**562.1 ha.+** **(1,390.2 acres+)**	**300,000**	

[1] Populations are identified by occurrence numbers listed in the CDFG NDDB

[2] A dash (-) indicates no data are available at this time

Table 9. Summary of Population Data for *Lupinus tidestromii*

Population[1] and Location	Approximate Size (hectares)[2]	Number of Individuals	Ownership
NDDB No. 1 Point Piños, Monterey County	-	Observation (1985)	Department of Transportation (DOT), U.S. Coast Guard
NDDB No. 2 Asilomar State Park, Monterey County	9.9 ha (24.5 acres)	Observation (1987)	DPR
NDDB No. 3 17 Mile Drive, Monterey County	-	Herbarium sheet (1919)	Private
NDDB No. 4 17 Mile Drive at Bird Rock, Monterey County	-	-	Private (Pebble Beach Company)
NDDB No. 5 Moss Beach, Monterey County	-	2 colonies (1985)	Moss Beach (DPR), Private
NDDB No. 6 Sawmill, Monterey County	-	Extirpated (1985)	Private
NDDB No. 7 Moss Beach, Monterey Co.	-	Extirpated (1985)	Private
NDDB No. 8 17 Mile Drive, Monterey County	-	(1948)	Private
NDDB No. 10 Signal Hill Rd., Monterey County	-	Map (1987)	Private
NDDB No. 11 Spanish Bay Golf Course, Monterey County	7.7 ha (19.0 acres)	Transplant	Private (Pebble Beach Company)
NDDB No. 12 (PRNS#3) Old Life Saving Station, Marin County	-	93 (1983) 107 (1987)	PRNS (NPS)
NDDB No. 13 (PRNS #1) Abbott's Lagoon, Marin County	155.0 ha (383.0 acres)		PRNS (NPS)

Table 9. Summary of Population Data for *Lupinus tidestromii* (Cont'd.)

Population[1] and Location	Approximate Size (hectares)[2]	Number of Individuals	Ownership
NDDB No. 14 (PRNS#2) North Beach, Marin County	7.2 ha (18 acres)	6 (1983) 9 (1988) 152 (1993)	PRNS (NPS)
NDDB No. 15 (PRNS#4) Abbots Lagoon, north, Marin County	-	30 (1990)	PRNS (NPS)
NDDB No. 16 Navy test site, Marin County	1.4 ha (3.6 acre)	21 (1991)	PRNS (NPS)
NDDB No. 17 Goat Rock, Sonoma County	0.01 ha (0.02 acre)	100+ (1987) 30 (1994)	DPR
NDDB No. 18 Dillon Beach, Marin County	-	2 (1992)	Private (Lawson's Landing)
NDDB No. 19 Ocean View Blvd., Marin County	-	Map (1987)	Unknown
TOTAL	**189 ha.+** **(468 acres+)**	**433**	

[1] Populations are identified by occurrence numbers listed in the 1994 CDFG NDDB and Calif. Dept. of Fish and Game 1985b.

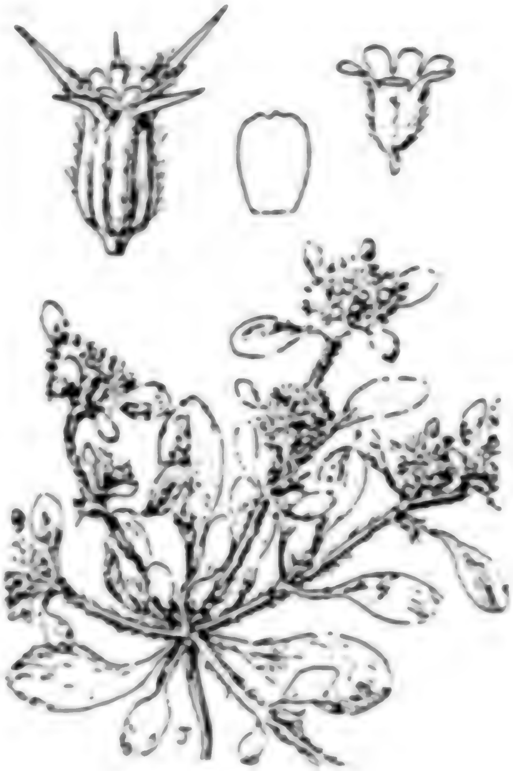
[2] A dash (-) indicates no data are available at this time.

Table 10. Summary of Population Data for *Speyeria zerene myrtleae*

Population[1] and Location	Approximate Size (hectares)[2]	Number of Individuals	Ownership
Central Point Reyes, Marin County	-	<5,000	PRNS (NPS)
Tomales Point, Marin County	-	<1,000?	PRNS (NPS)
Marin Coast Golf Ranch site, Marin County	510.0 ha (1,260.2 acres)	2,500-5,000	Private
TOTAL	**510.0 ha+ (1,260.2 acres)**	**<10,000**	

[1] Populations are identified by occurrence numbers listed in the 1994 CDFG NDDB.

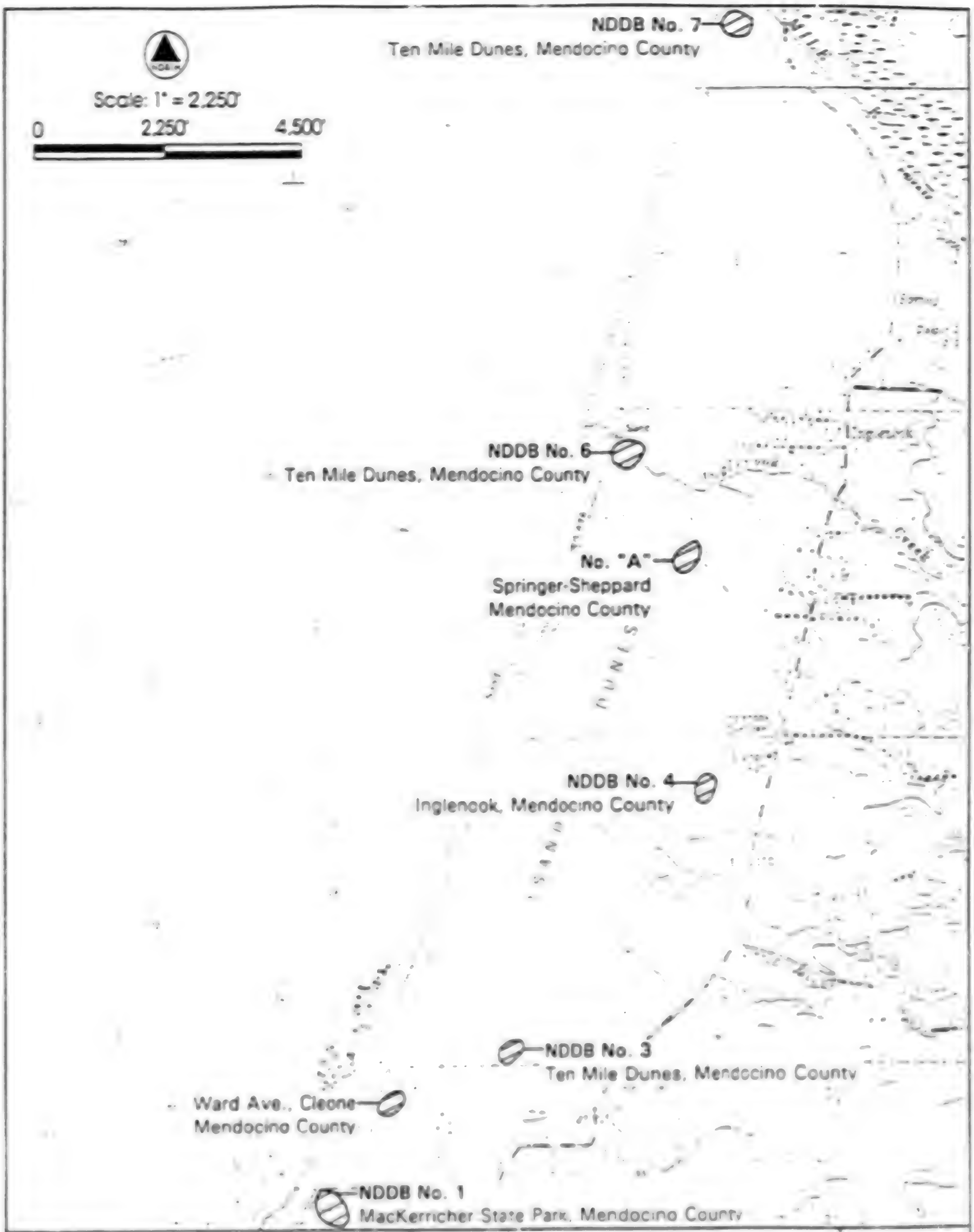
[2] A dash (-) indicates no data are available at this time.



Source: Abrams L. 1944
Illustrated Flora of the Pacific States. Vol. II. Fig. 1226
Stanford University Press, Stanford, CA

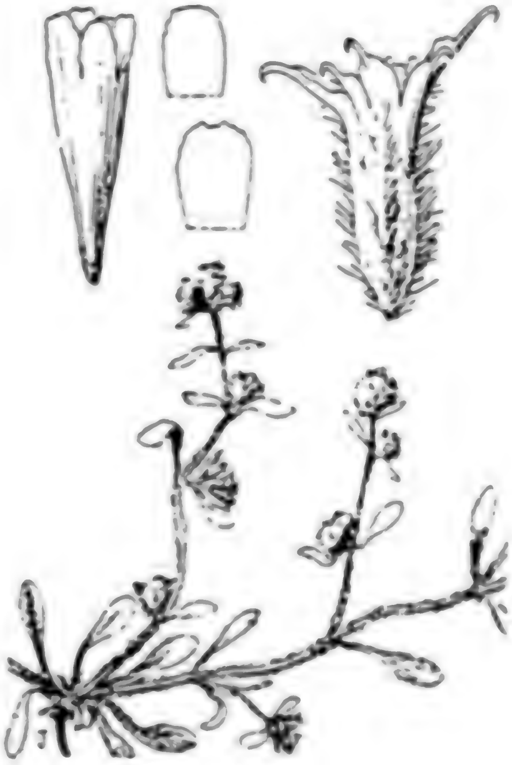
Plant Identification
Chorizanthe howellii
RECOVERY PLAN

FIGURE 1



Approximate Distribution of *Chorizanthe howellii*
RECOVERY PLAN

FIGURE 2

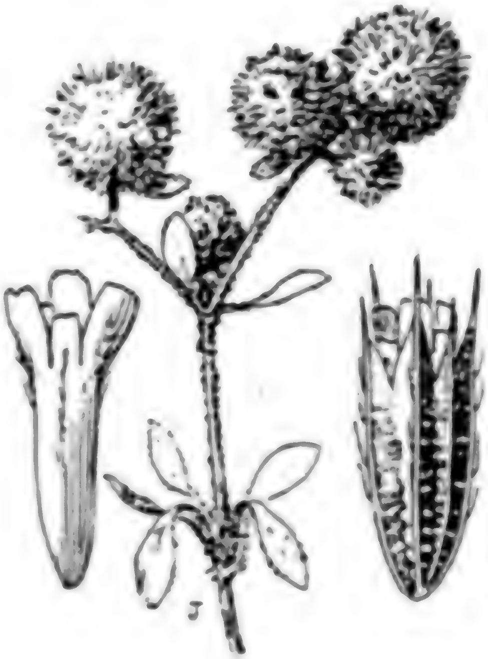


Source: Abrams, L. 1955
Illustrated Flora of the Pacific States, Vol. II, Fig. 1[illegible]
Stanford University Press. Stanford, CA

Plant Identification
Chorizanthe pungens var. *pungens*
RECOVERY PLAN

FIGURE 3

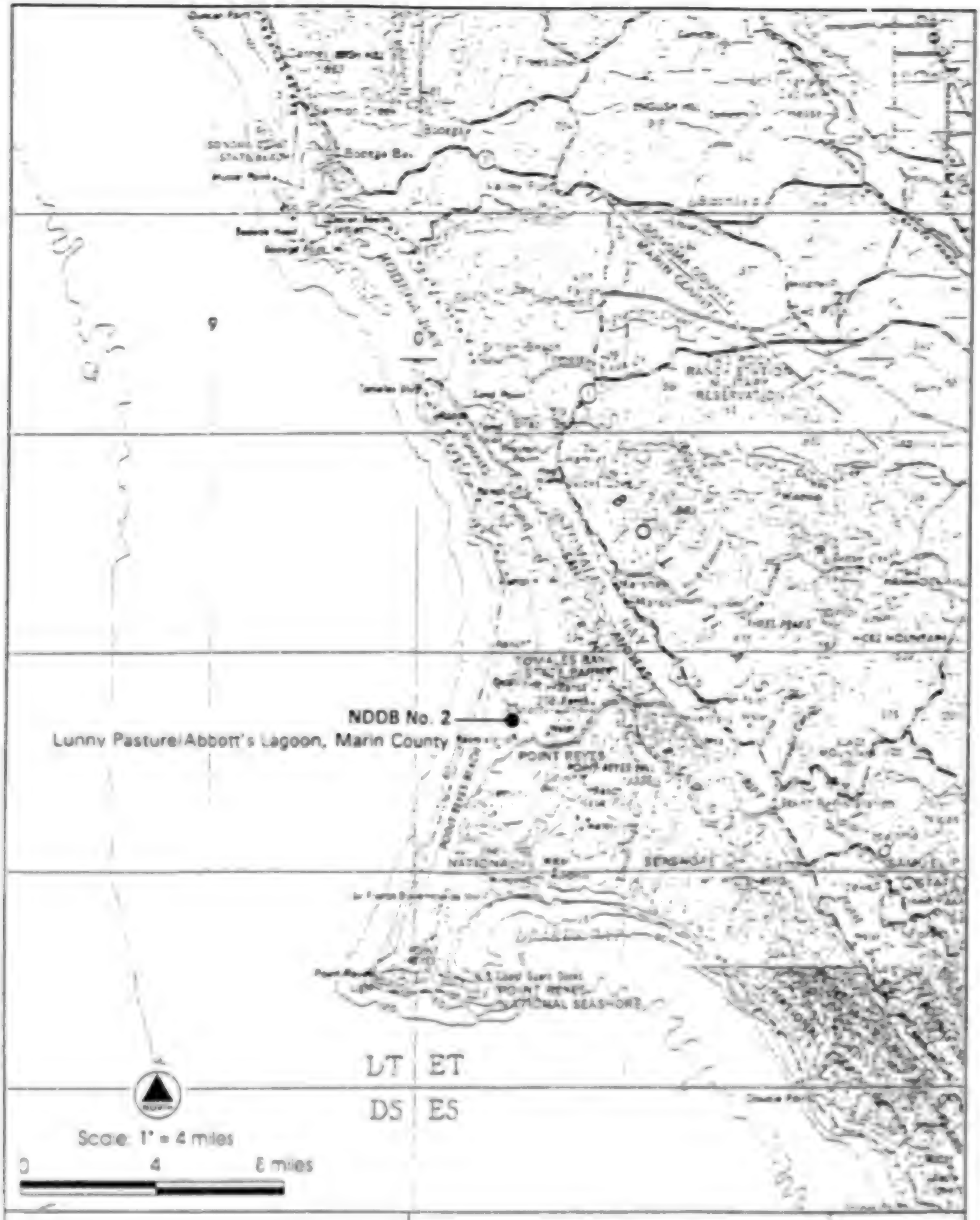
62



Source: Abrams, L. 1953
Illustrated Flora of the Pacific States, Vol. II, Fig. 1325
Stanford University Press, Stanford, CA

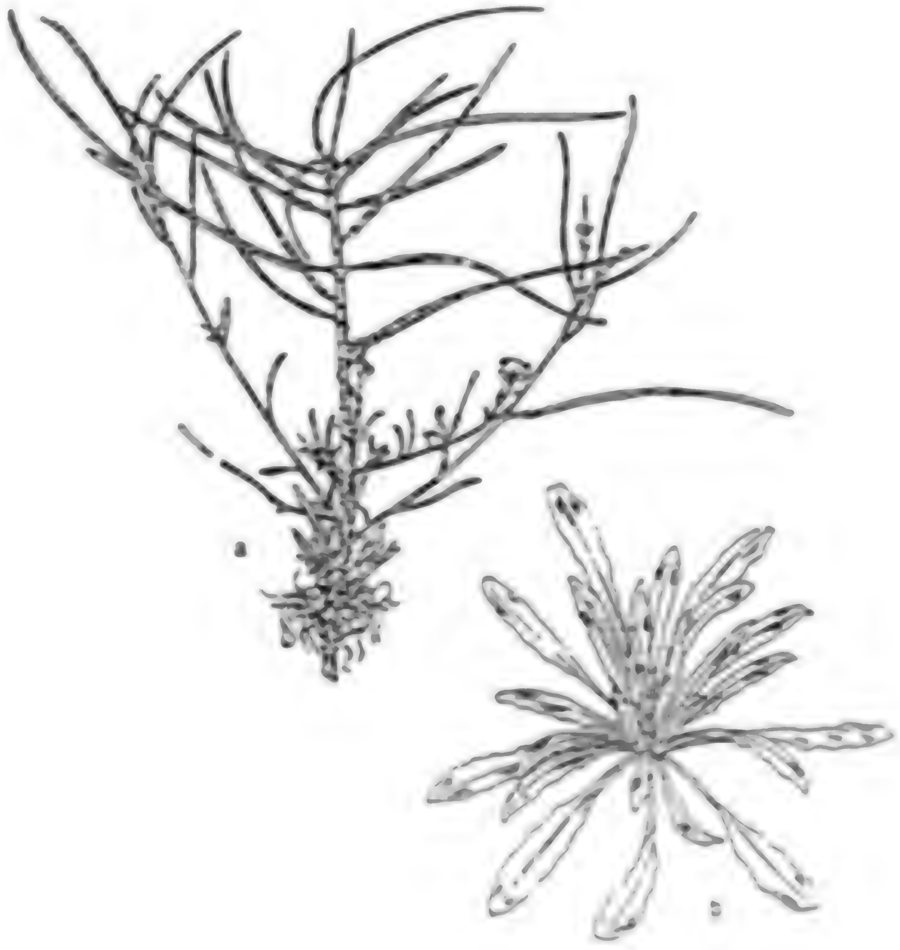
Plant Identification
Chorizanthe valida
RECOVERY PLAN

FIGURE 5



Approximate Distribution of *Chorizanthe valida*
RECOVERY PLAN

FIGURE 6

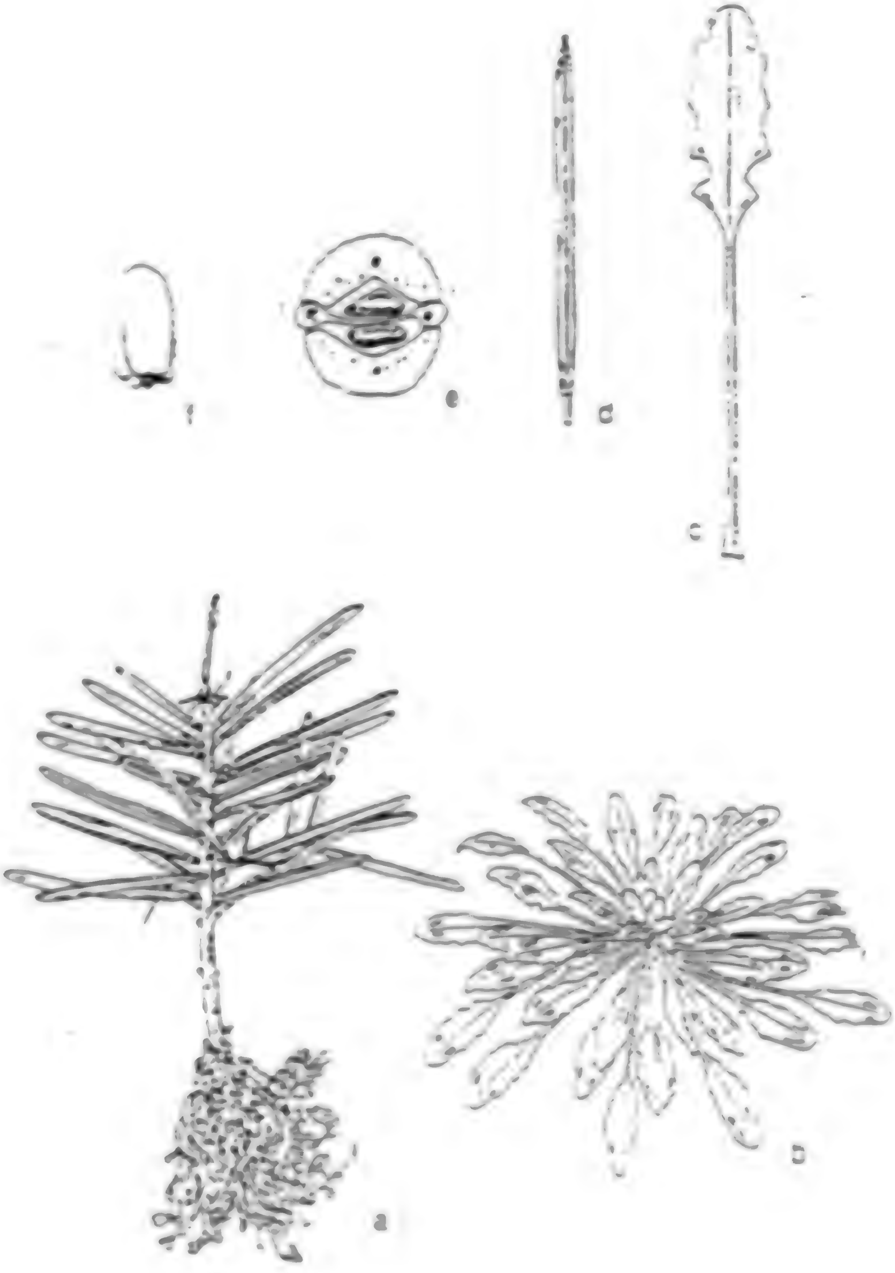


Source: Price, R.A. (1987) Plate III, Fig. 1

Plant Identification
Erysimum menziesii ssp. eurekense
RECOVERY PLAN

FIGURE 7

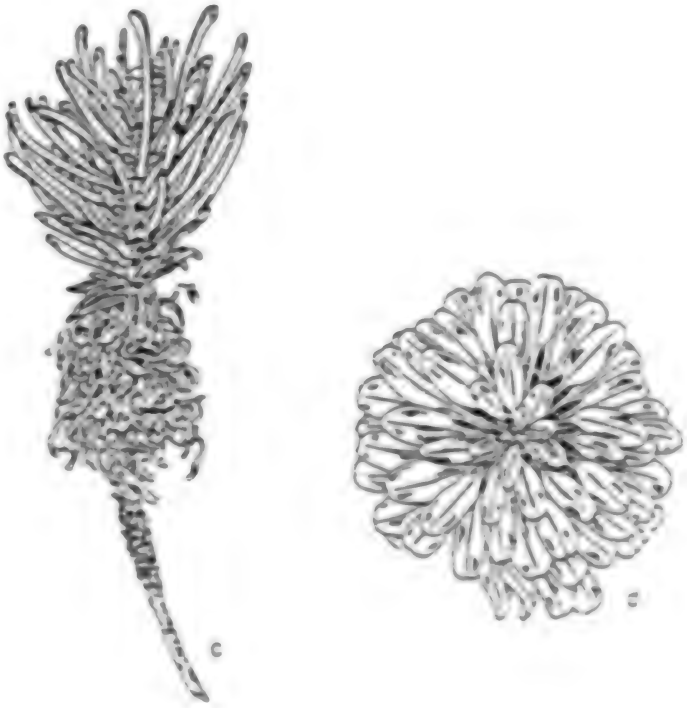
65



Source: [illegible]

Plant Identification
Erysimum menziesii ssp. *menziesii*
RECOVERY PLAN

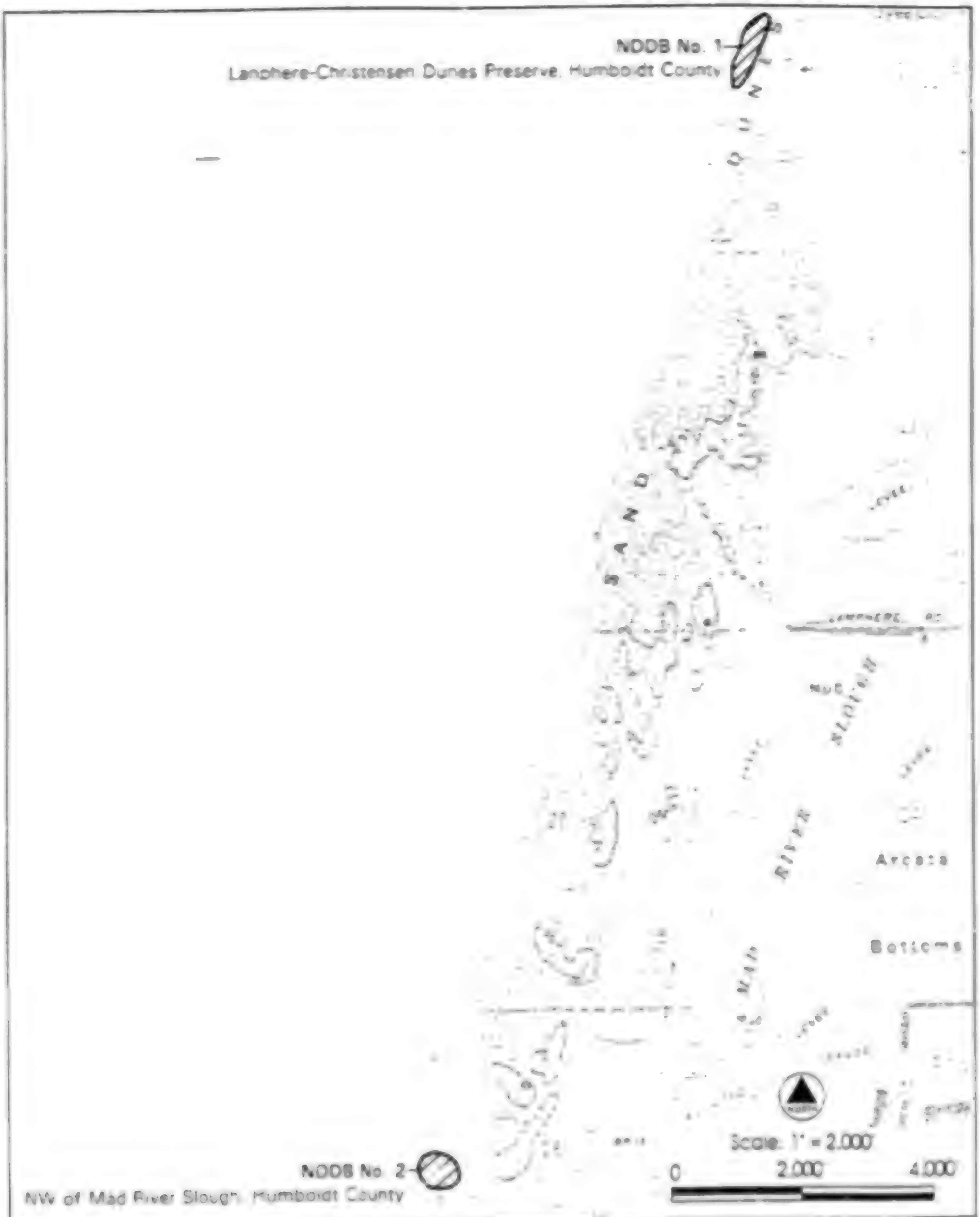
FIGURE 8



Source: Price, R.A. (1987). Page 807, Fig. 28

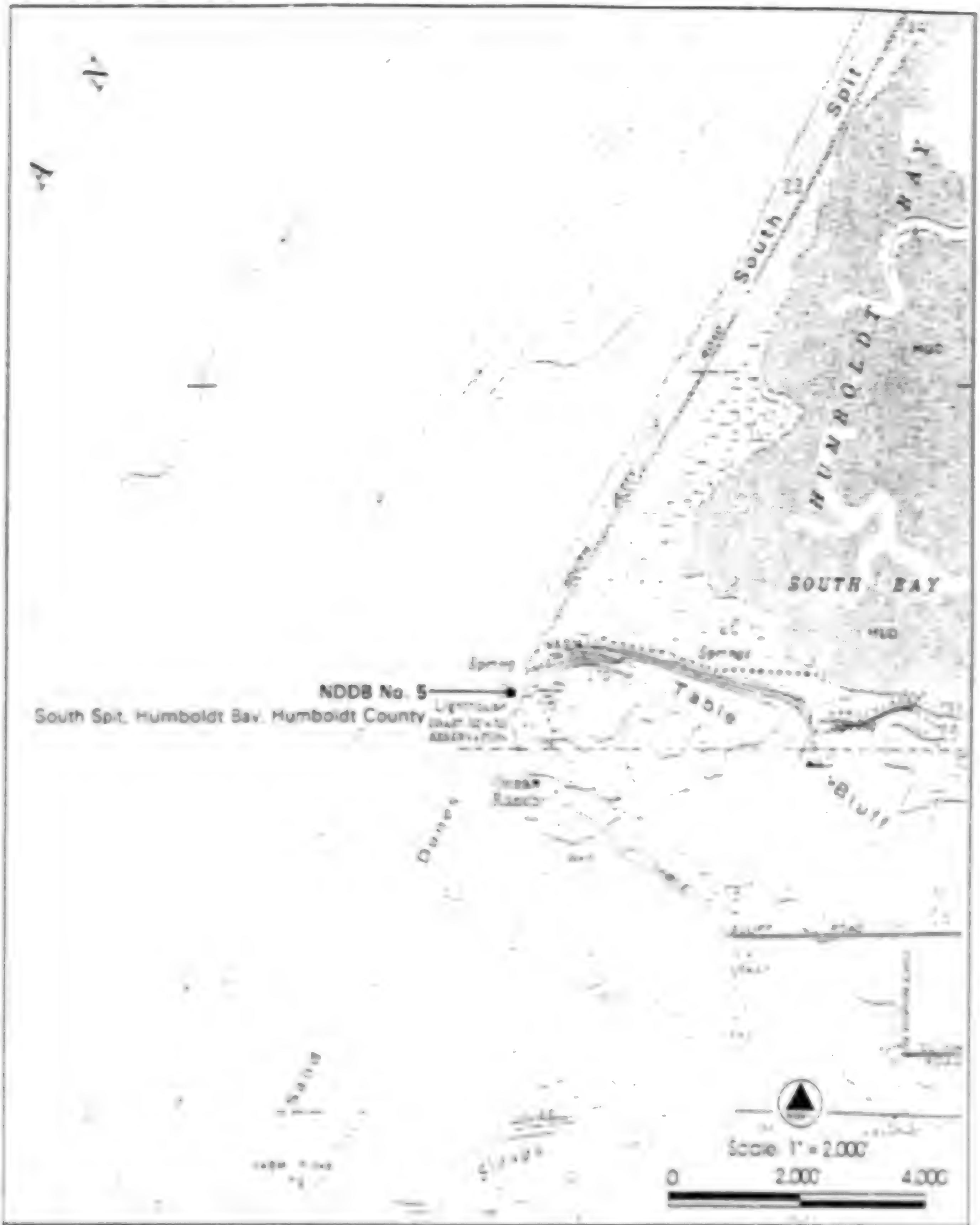
Plant Identification
Erysimum menziesii ssp. yadonii
RECOVERY PLAN

FIGURE 9



Approximate Distribution of
Erysimum menziesii ssp. *eurekense*
RECOVERY PLAN

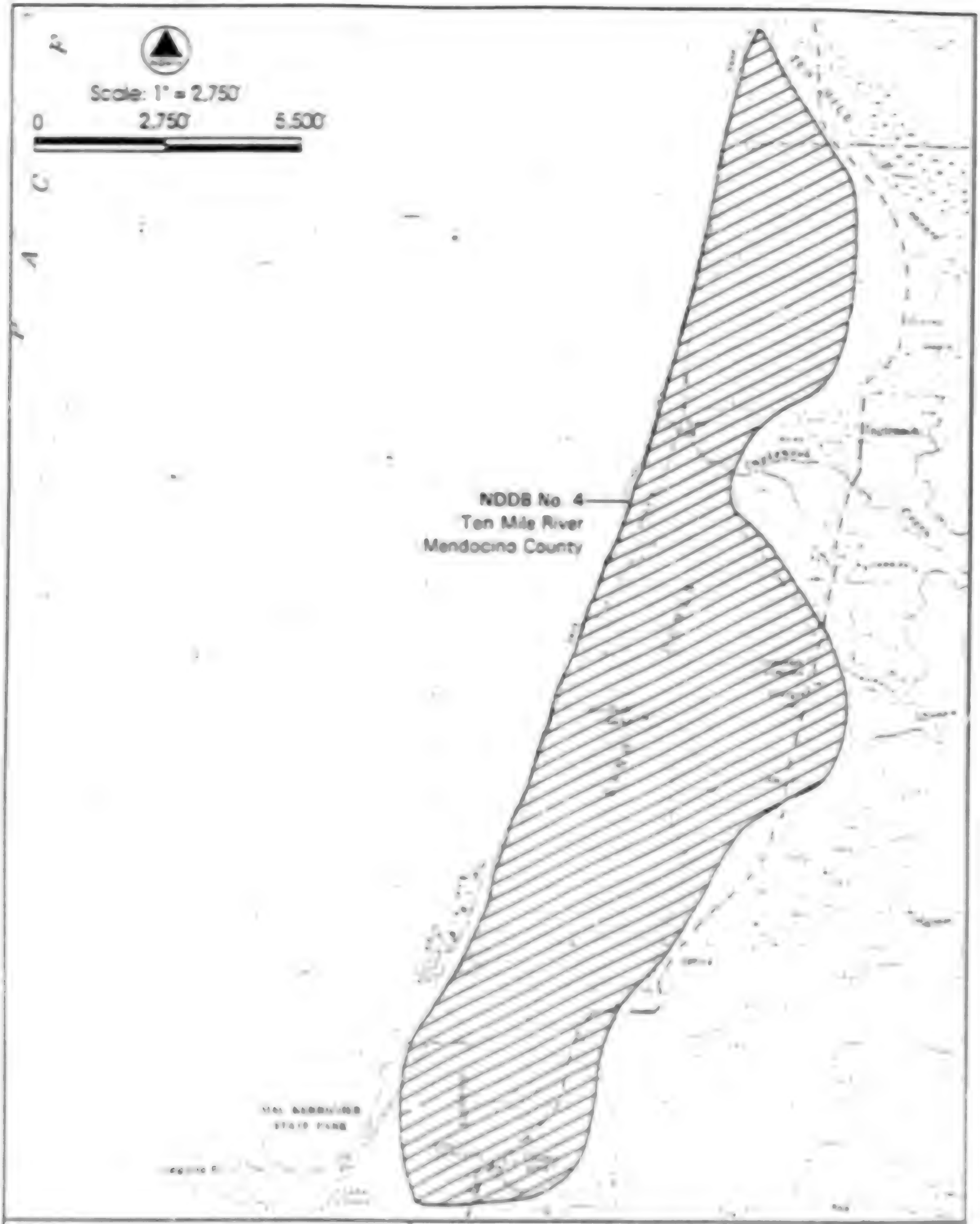
FIGURE 10



NDDB No. 5
South Spit, Humboldt Bay, Humboldt County

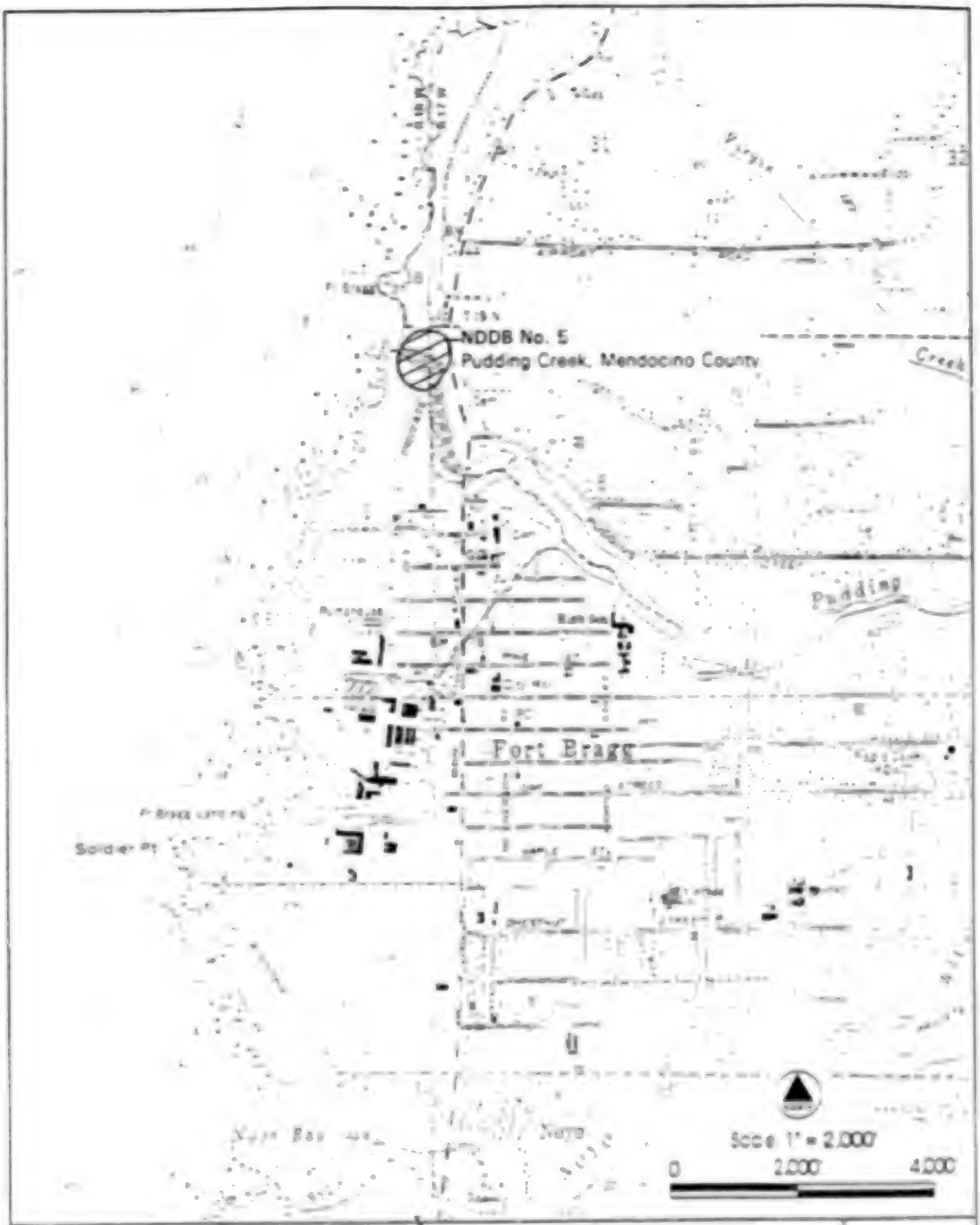
Approximate Distribution of
Erysimum menziesii ssp. *eurekense*
RECOVERY PLAN

FIGURE 12



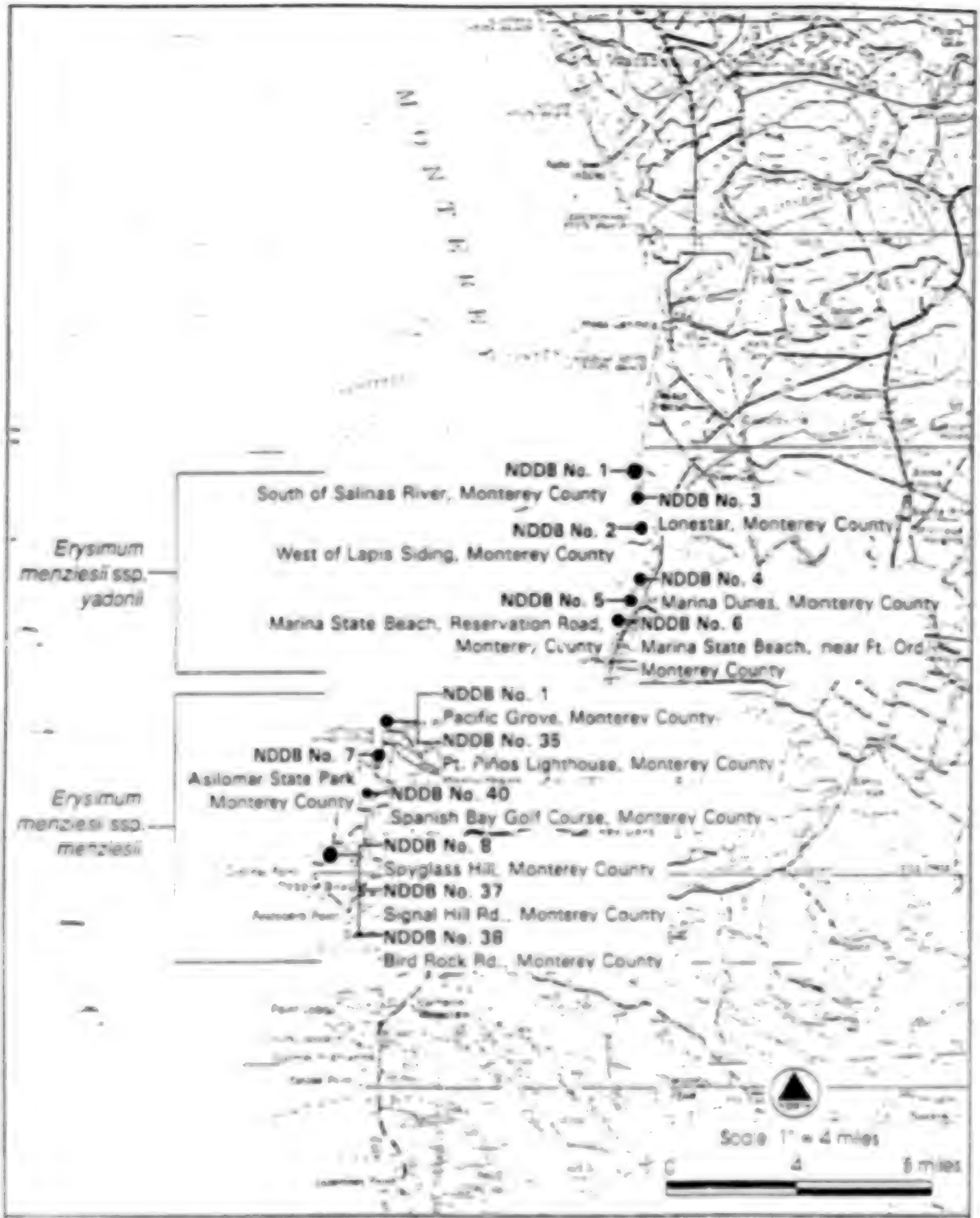
Approximate Distribution of
Erysimum menziesii ssp. *menziesii*
RECOVERY PLAN

FIGURE 13

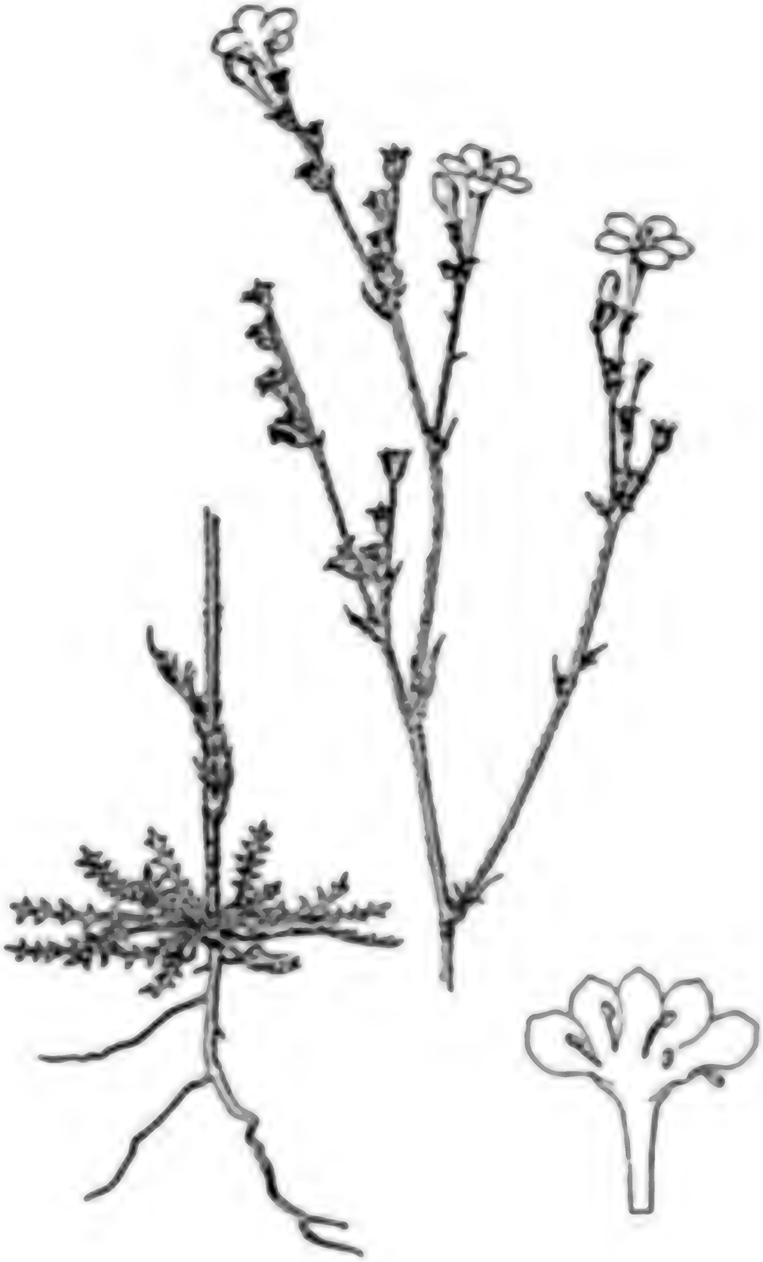


Approximate Distribution of
Erysimum menziesii ssp. *menziesii*
RECOVERY PLAN

FIGURE 14


Erysimum menziesii ssp. yadonii
NDDB No. 1
South of Salinas River, Monterey County
NDDB No. 3
NDDB No. 2
Lonestar, Monterey County
West of Lapis Siding, Monterey County
NDDB No. 4
NDDB No. 5
Marina Dunes, Monterey County
Marina State Beach, Reservation Road, Monterey County
NDDB No. 6
Marina State Beach, near Ft. Ord Monterey County
Erysimum menziesii ssp. menziesii
NDDB No. 1
Pacific Grove, Monterey County
NDDB No. 35
NDDB No. 7
Pt. Piños Lighthouse, Monterey County
Asilomar State Park Monterey County
NDDB No. 40
Spanish Bay Golf Course, Monterey County
NDDB No. 8
Spyglass Hill, Monterey County
NDDB No. 37
Signal Hill Rd., Monterey County
NDDB No. 38
Bird Rock Rd., Monterey County
Scale 1" = 4 miles
0
4
8 miles

	Approximate Distribution of Erysimum menziesii ssp. menziesii and Erysimum menziesii ssp. yadonii RECOVERY PLAN	FIGURE 15

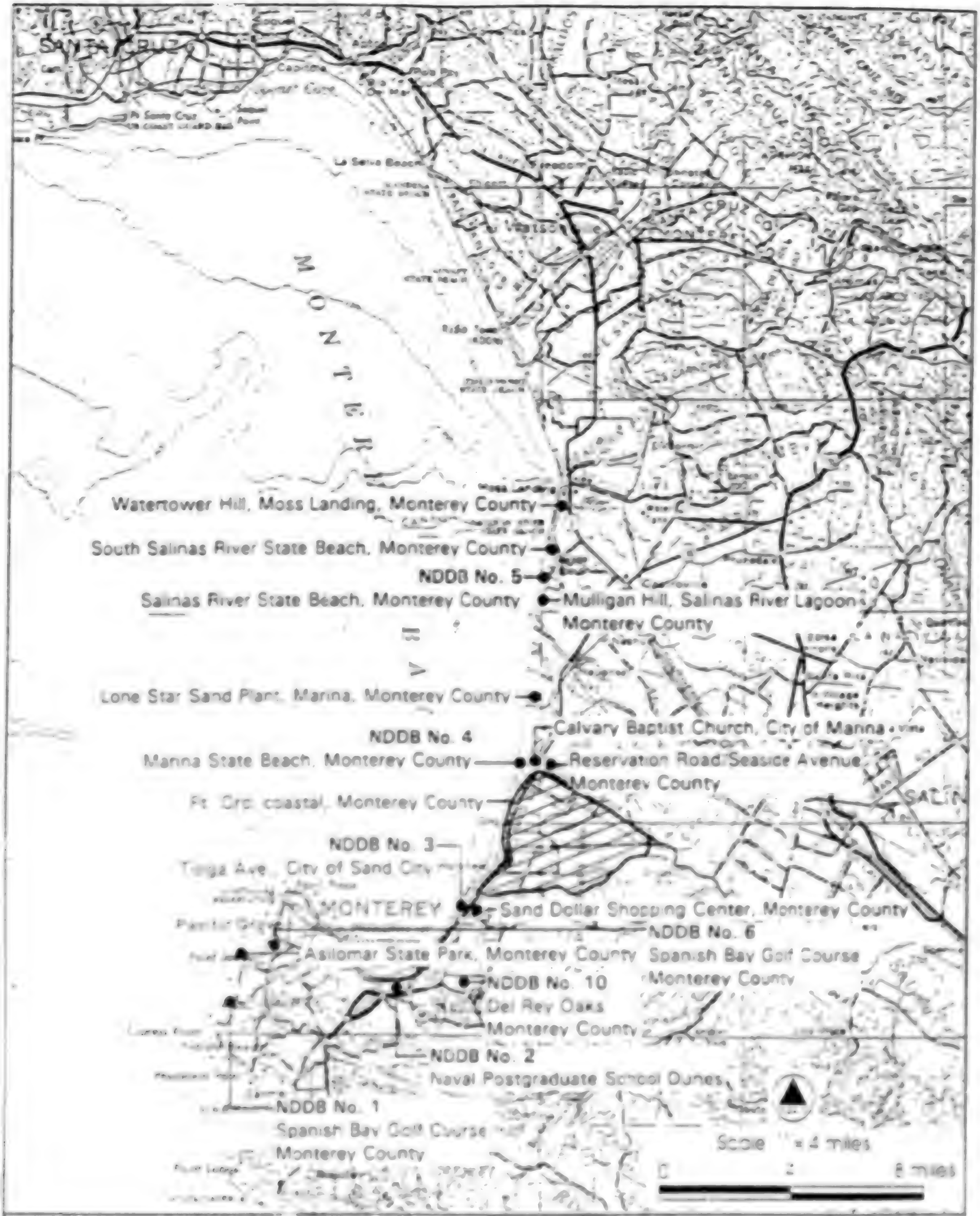


Source: Abrams, L. 1951.
Illustrated Flora of the Pacific States, Vol. III, Fig. 4034
Stanford University Press, Stanford, CA

Plant Identification
Gilia tenuiflora
RECOVERY PLAN

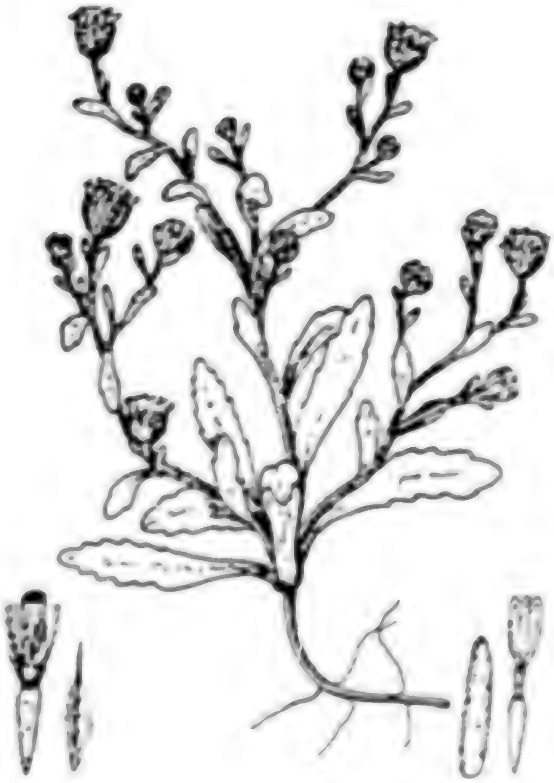
FIGURE 16

73


SANTA CRUZ
Capitola
La Selva Beach
M O N T E R E Y
B A Y
Watertower Hill, Moss Landing, Monterey County
South Salinas River State Beach, Monterey County
NDDB No. 5
Salinas River State Beach, Monterey County
Mulligan Hill, Salinas River Lagoon
Monterey County
Lone Star Sand Plant, Marina, Monterey County
Calvary Baptist Church, City of Marina
NDDB No. 4
Marina State Beach, Monterey County
Reservation Road/Seaside Avenue
Monterey County
Ft. Ord coastal, Monterey County
SALIN
NDDB No. 3
Tioga Ave., City of Sand City
MONTEREY
Pacific Grove
Sand Dollar Shopping Center, Monterey County
NDDB No. 6
Spanish Bay Golf Course
Monterey County
Asilomar State Park, Monterey County
NDDB No. 10
Del Rey Oaks
Monterey County
NDDB No. 2
Naval Postgraduate School Dunes
NDDB No. 1
Spanish Bay Golf Course
Monterey County
Scale 1" = 4 miles
0
4
8 miles

Approximate Distribution of
Gilia tenuiflora ssp. *arenaria*
RECOVERY PLAN

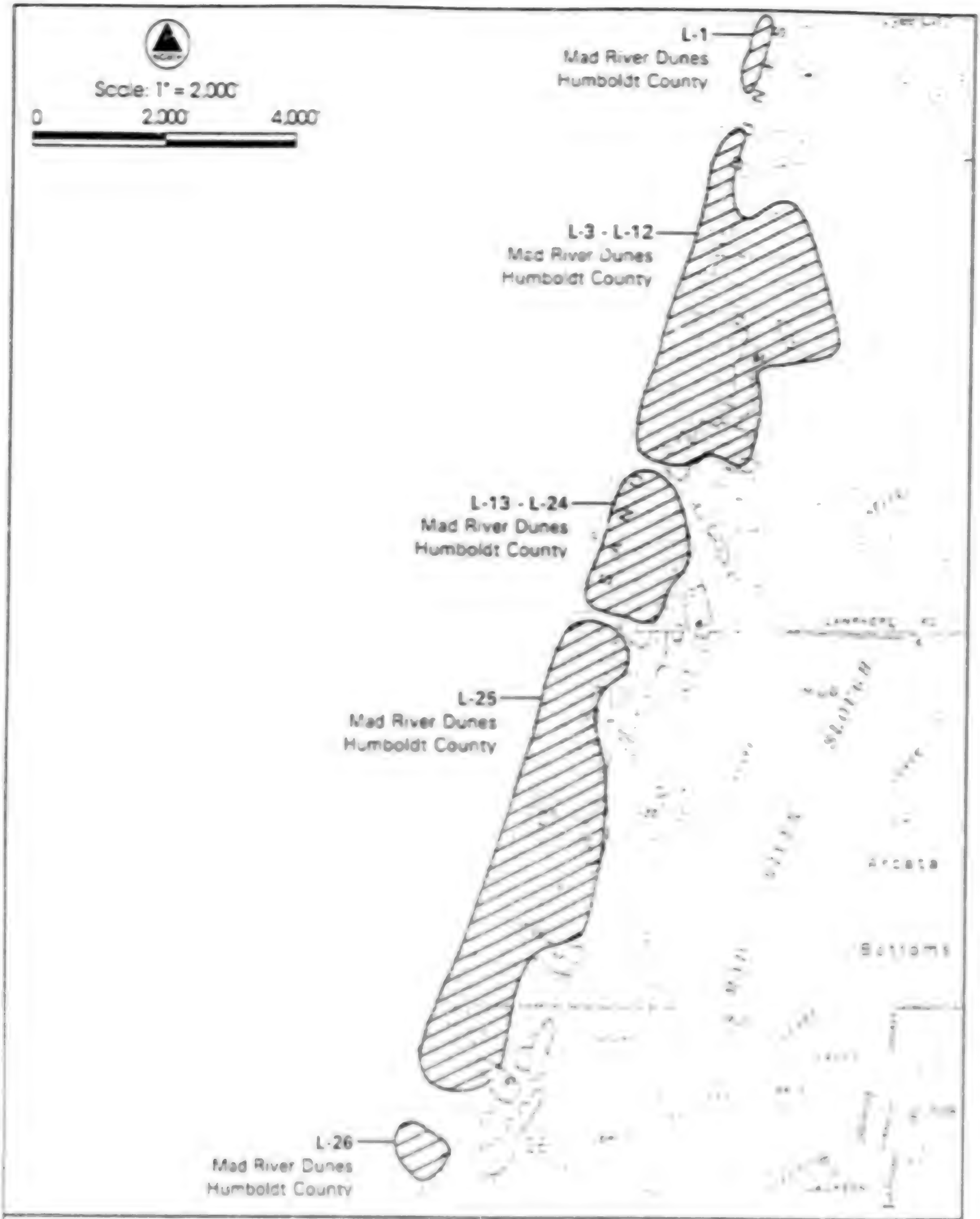
FIGURE 17



Source: Abrams, L. and R. Ferris. 1960
Illustrated Flora of the Pacific States. Vol. IV, Fig. 5110
Stanford University Press, Stanford, CA

Plant Identification
Layia carnosa
RECOVERY PLAN

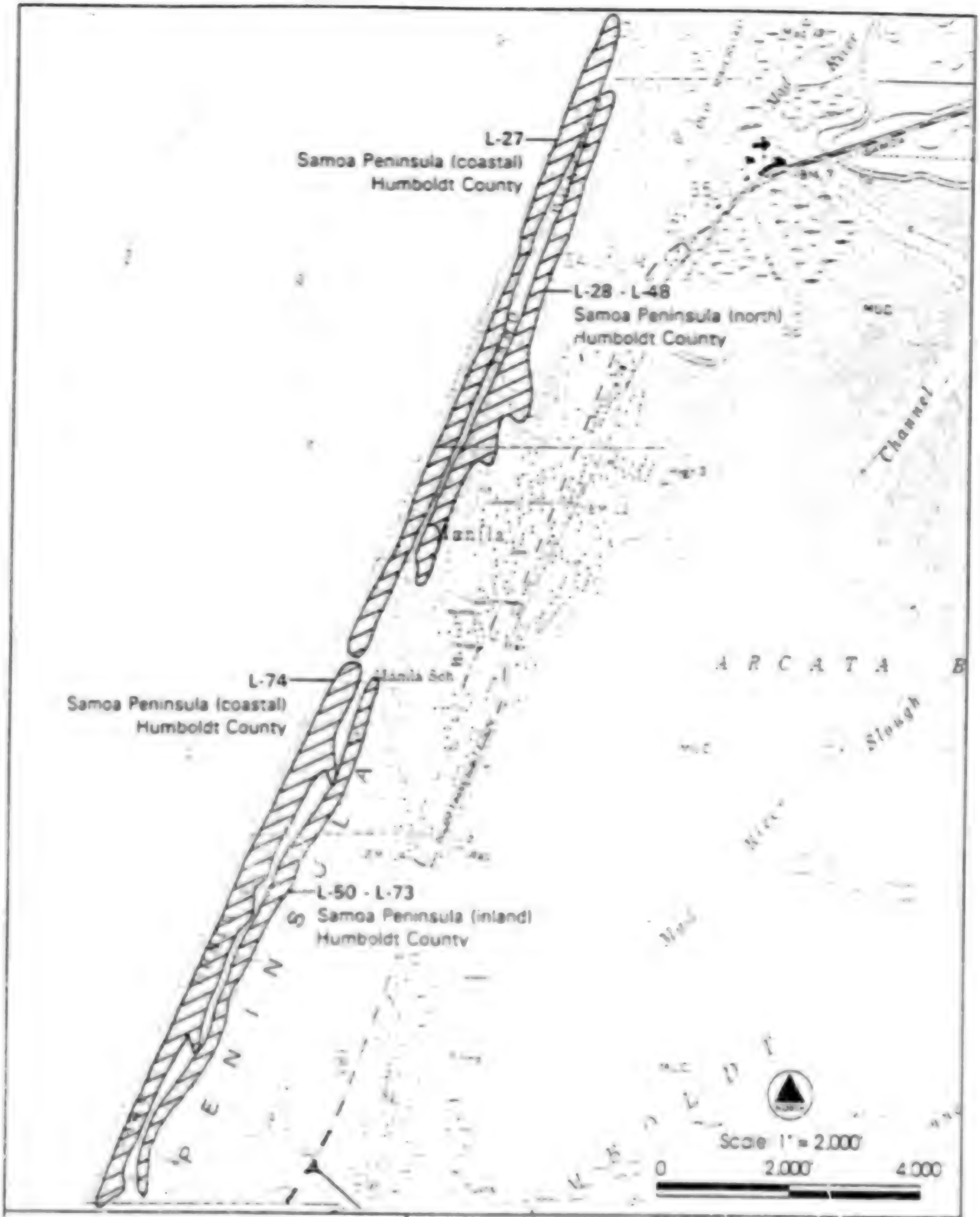
FIGURE 18



Approximate Distribution of *Layia carnosa*
RECOVERY PLAN

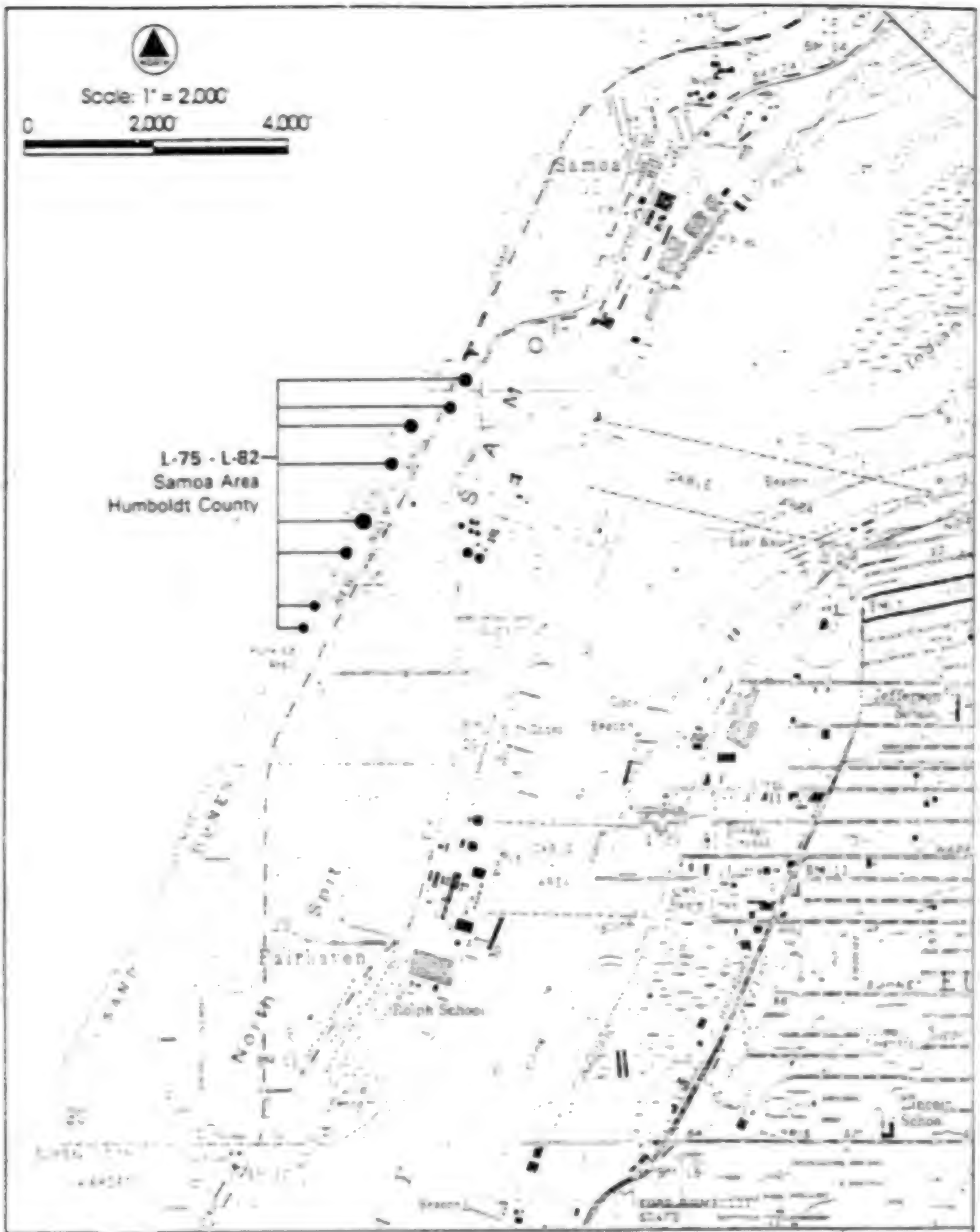
FIGURE 19

76



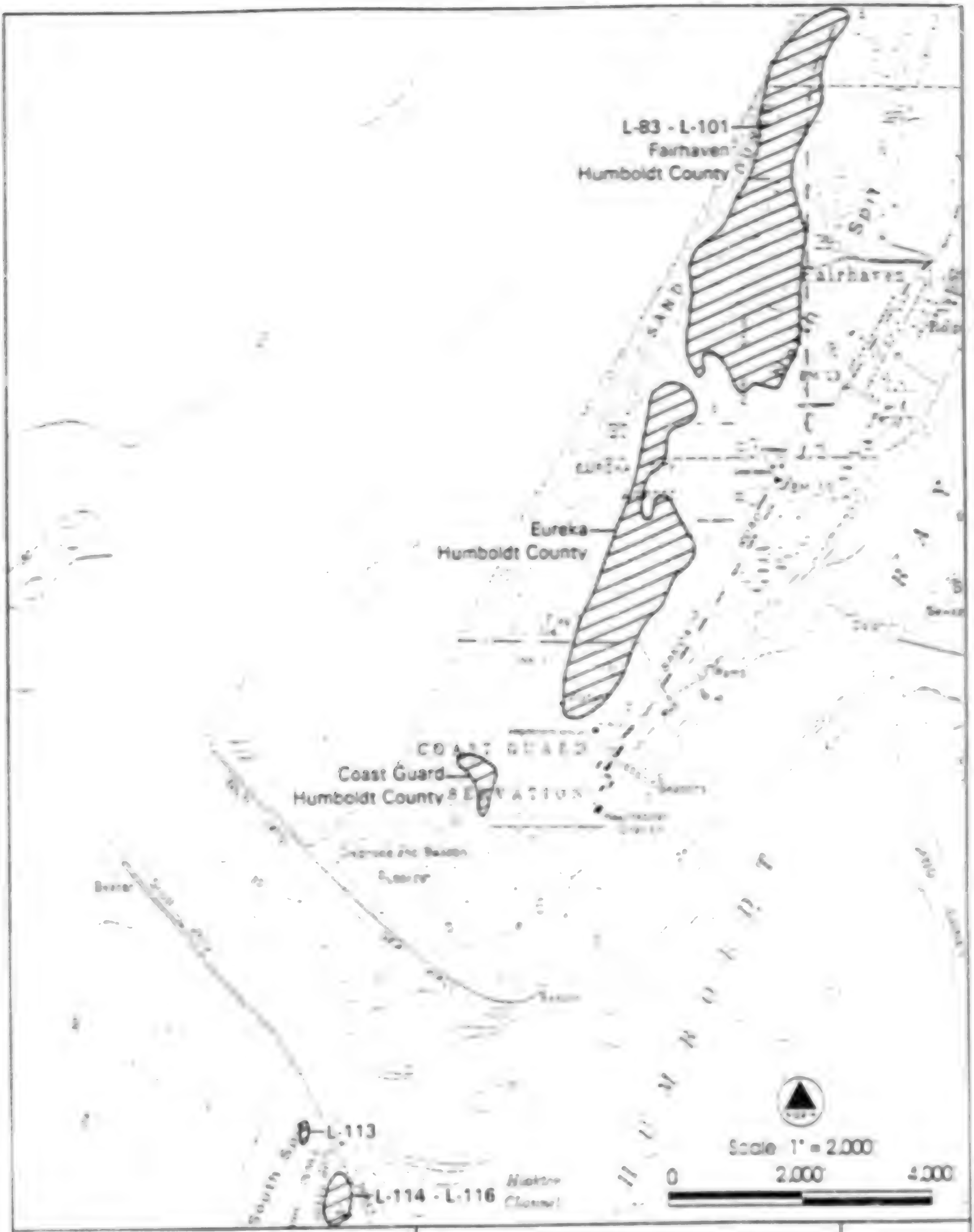
Approximate Distribution of *Layia carnosa*
RECOVERY PLAN

FIGURE 20



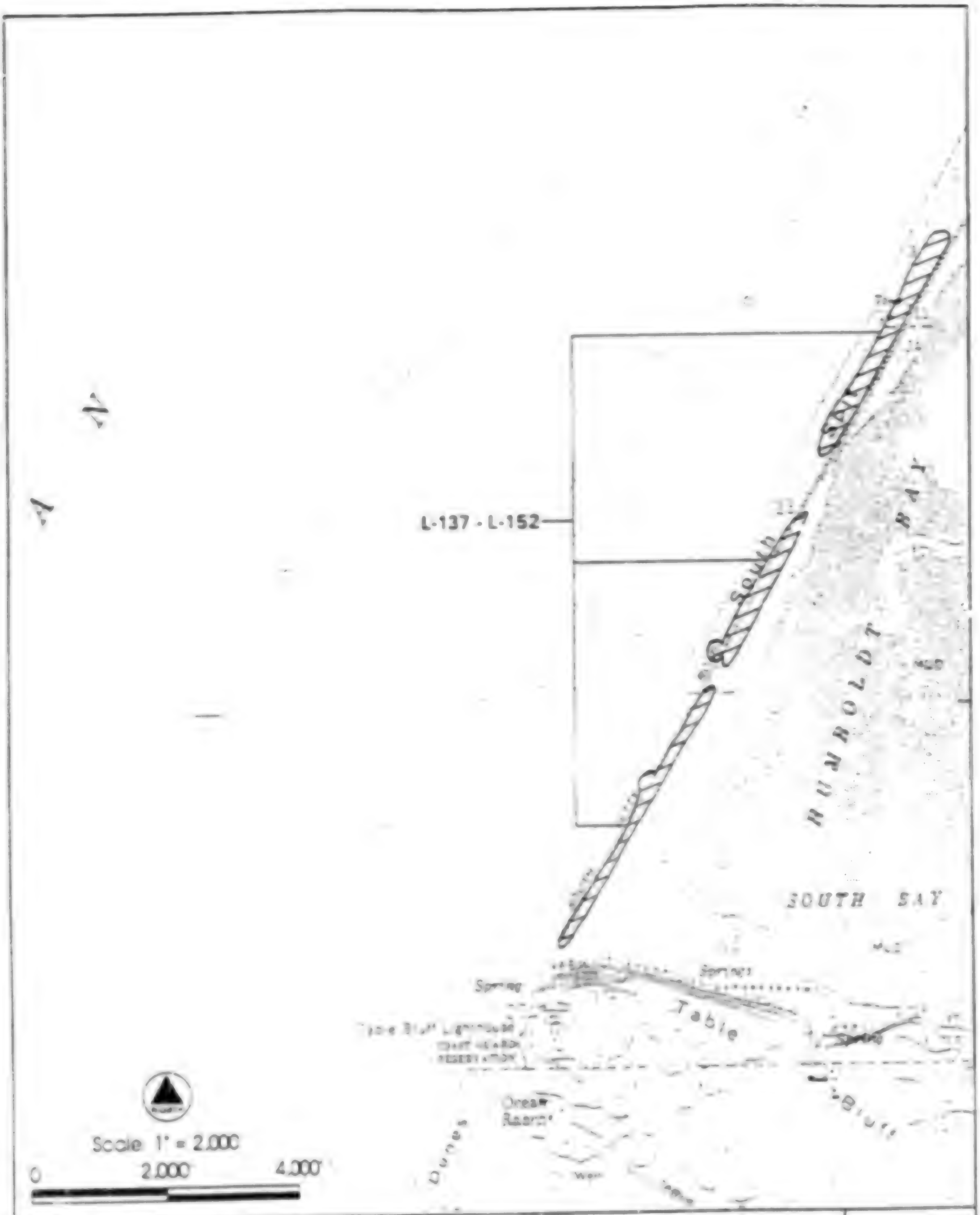
Approximate Distribution of *Layia carnosa*
RECOVERY PLAN

FIGURE 21



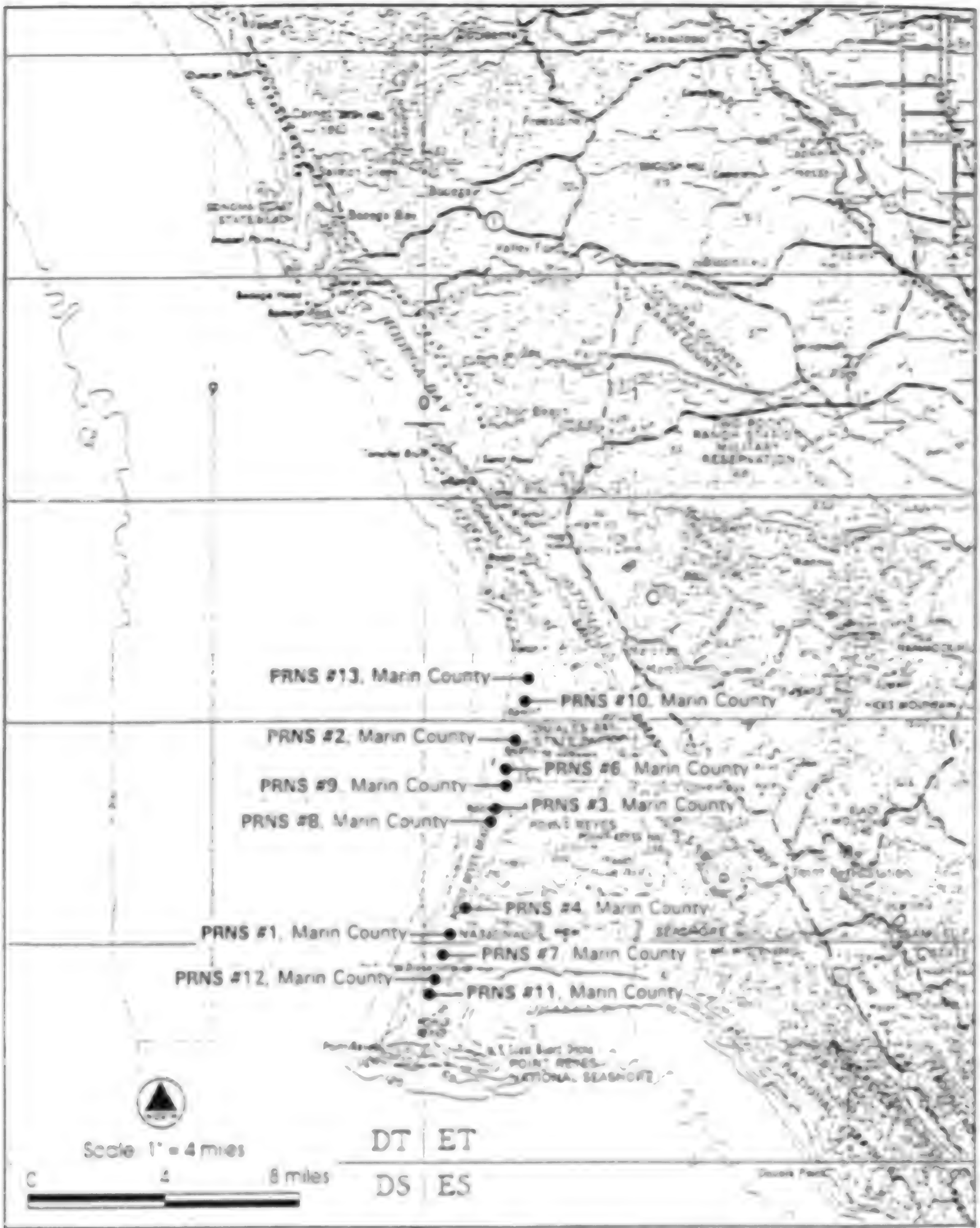
Approximate Distribution of *Layia carnosa*
RECOVERY PLAN

FIGURE 22



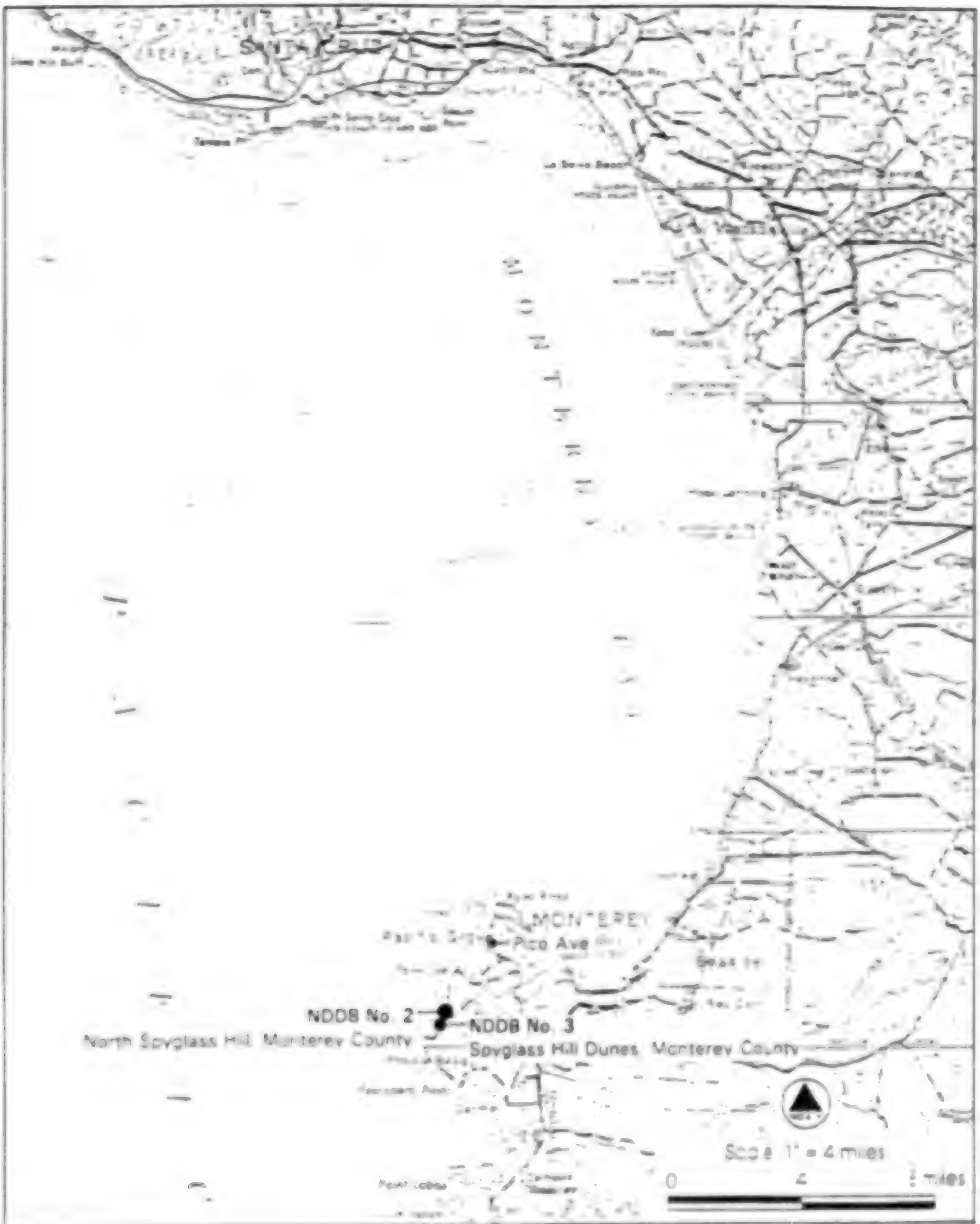
Approximate Distribution of
Layia carnosa
RECOVERY PLAN

FIGURE 23



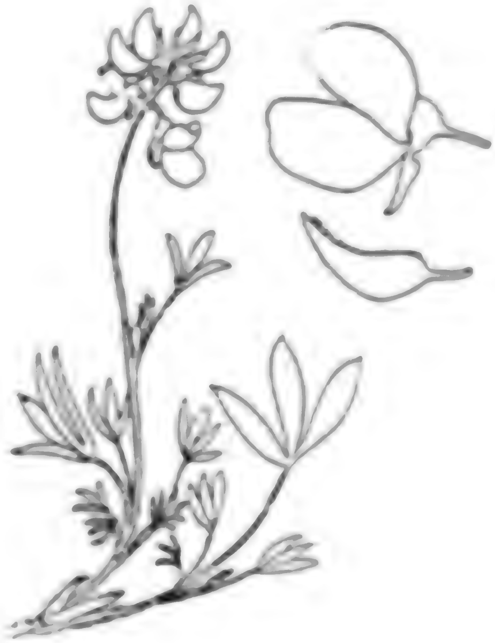
Approximate Distribution of *Layia carnosa*
RECOVERY PLAN

FIGURE 25



Approximate Distribution of
Layia carnosa
RECOVERY PLAN

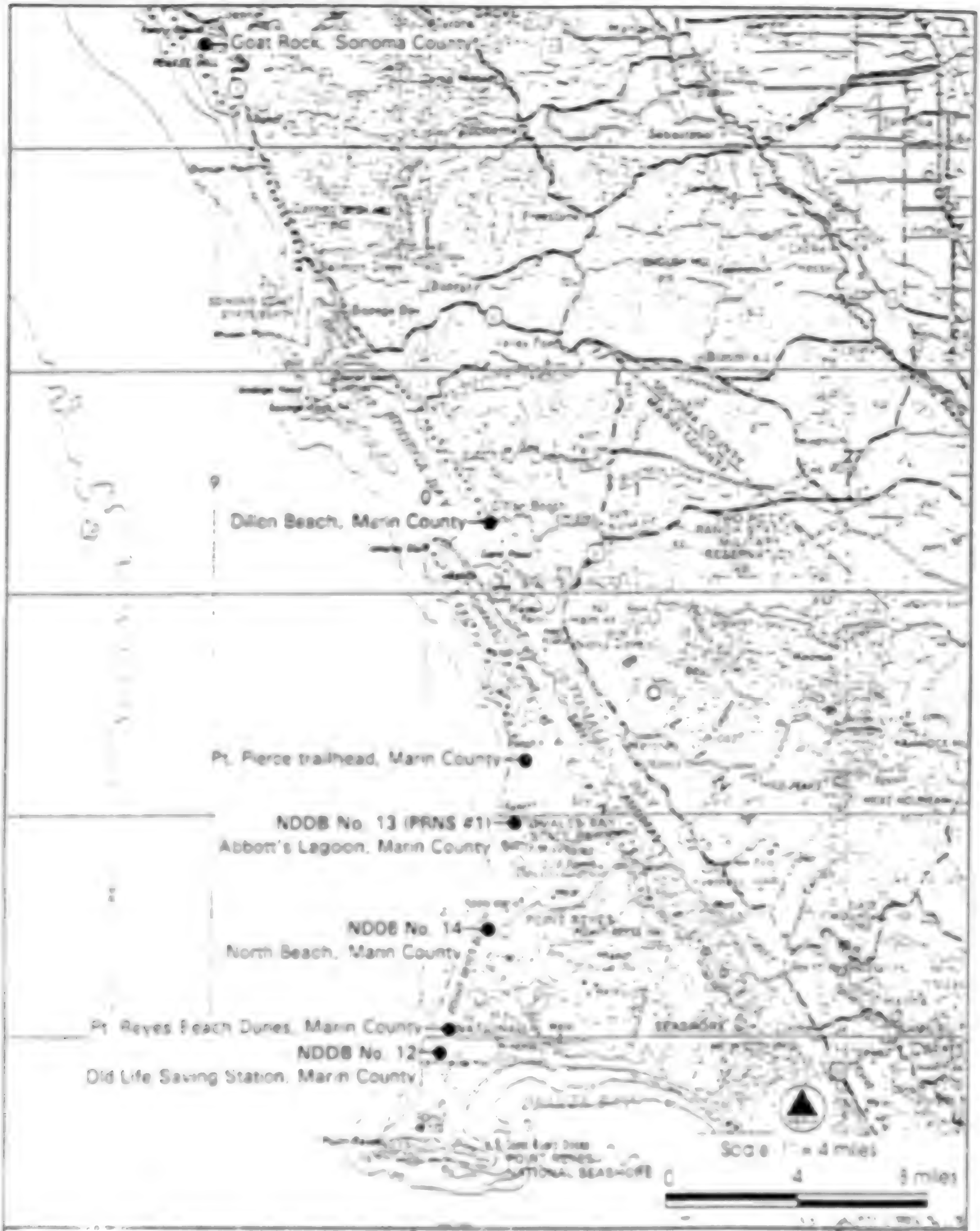
FIGURE 26



Source: Abrams, L. 1944.
Illustrated Flora of the Pacific States. Vol. II, Fig. [illegible]
Stanford University Press, Stanford, CA

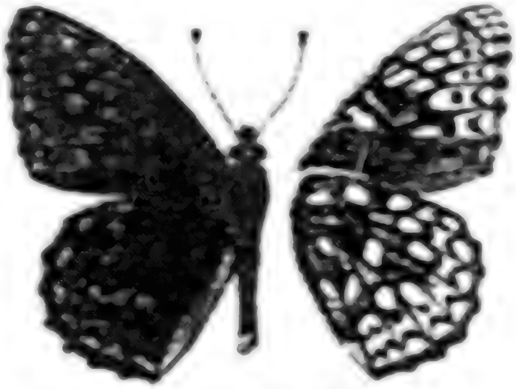
Plant Identification
Lupinus tidestromii
RECOVERY PLAN

FIGURE 27

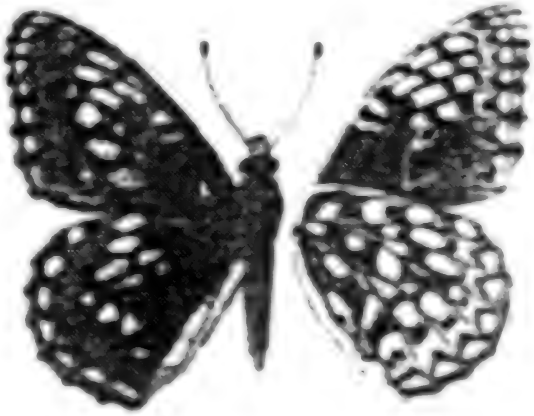

Goat Rock, Sonoma County
Dillon Beach, Marin County
Pt. Pierce trailhead, Marin County
NDDB No. 13 (PRNS #1)
Abbott's Lagoon, Marin County
NDDB No. 14
North Beach, Marin County
Pt. Reyes Beach Dunes, Marin County
NDDB No. 12
Old Life Saving Station, Marin County
Scale 1" = 4 miles
0
4
8 miles

Approximate Distribution of
Lupinus tidestromii
RECOVERY PLAN

FIGURE 28



Speyeria zerene myrtleae, male



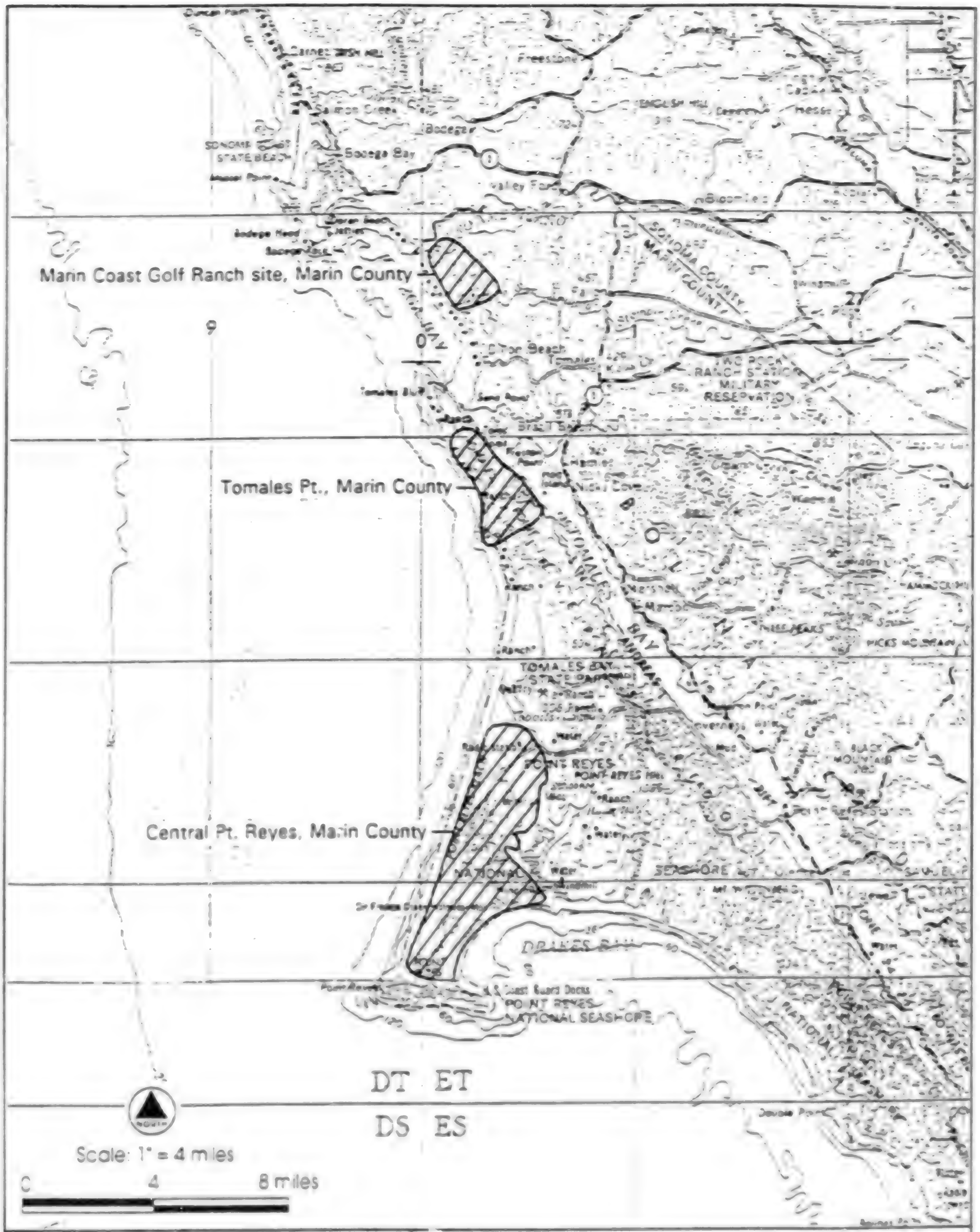
Speyeria zerene myrtleae, female

Source: William H. Howe, 1975
The Butterflies of North America

Identification
Myrtle's Silverspot Butterfly
RECOVERY PLAN

FIGURE 30

BLANK PAGE



Approximate Distribution of
Myrtle's Silverspot Butterfly
RECOVERY PLAN

FIGURE 31

II. RECOVERY

A. OBJECTIVE AND CRITERIA

The objective of this recovery plan is to delist all eight taxa covered by the plan in a minimum of ten years, with the possible exception of *Chorizanthe valida*, which is known from only one site. Reclassification to threatened status will come before delisting for the endangered *Chorizanthe howellii*, *C. valida*, *Erysimum menziesii*, *Gilia tenuiflora* ssp. *arenaria*, *Layia carnosa*, *Lupinus tidestromii*, and Myrtle's silverspot butterfly. For the threatened *Chorizanthe pungens* var. *pungens*, the recovery objective is delisting.

Although knowledge of the life histories of these taxa is limited with respect to requirements for their short- and long-term survival, criteria for downlisting and delisting are established here using the best available information. These criteria will be revised and quantified as additional information is provided by monitoring programs and documented management results.

The immediate objective of this plan is to minimize the threats to the species and the habitats upon which they depend.

Recovery Criteria

A. Downlisting Criteria

The following conditions must be met before considering downlisting *Chorizanthe howellii*, *Chorizanthe valida*, the three endangered subspecies *Eryngium menziesii*, *Layia carnosa*, *Lupinus tidestromii*, and Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*)
- habitat occupied by the species that is needed to allow delisting has been secured, with long-term commitments to conservation of the native vegetation,
- management measures are being implemented to address the threats of invasive species and other problems, including grazing, pedestrians, and off-road vehicles at some sites.
- monitoring reveals that management actions are successful in reducing threats of invasive non-native species.

In addition to these criteria, for *Chorizanthe valida* (Sonoma spineflower) to be considered for downlisting
- management plans must be approved and implemented for the one population and
- additional populations that may be needed for recovery have been identified have been established and those populations are self sustaining.

B. Delisting Criteria

Full recovery of these taxa will be achieved when they are naturally reproducing, stable or increasing in numbers, and secure from threats. To assure that this is the case, populations should be measured and monitored over a ten-year period to include wet and drought years. The species can be considered for delisting when sites are secure from habitat modification (development) and occupied habitat is stable or improving and free of weed invasion.

The threatened *Chorizanthe pungens* var. *pungens* (Monterey spineflower) may be considered for delisting when the Fort Ord disposal and reuse process has led the various management agencies to develop, fund, and implement permanent protection plans for the species' habitat. Plans at the time of writing to conserve roughly 60 percent of Fort Ord appear sufficient for recovery, a reassessment would be made should plans call for conservation of less habitat.

The specific sites required for the recovery of each species are as follows:

Chorizanthe howellii (Howell's spineflower) may be considered for delisting when management of all protected areas in MacKerricher State Park is beneficial to this species. Management plan(s) that identify conservation of *Chorizanthe howellii* as a goal should be developed and implemented. Additional protection for the two populations on private land and portion of one population that extends into private land from MacKerricher State Park would conserve the plant at all of its historically known locations.

Erysimum menziesii (Menzies' wallflower) can be considered for delisting when
- the existing populations of each of the three subspecies discussed in this rule are protected from development, invasive weeds, and predators,
- *E. m.* ssp. *eurkensis* has three populations with an average of 300 individuals and two populations with 5,000 or more individuals
- *E. m.* ssp. *menziesii* has five populations with an average of 300 individuals per population, and
- *E. m.* ssp. *yadonii* has three populations with an average of 300 individuals per population and two populations with 5,000 or more individuals.

Gilia tenuiflora ssp. *arenaria* (Monterey gilia) can be considered for delisting when
- populations on private lands are protected and managed for 1,000 (NDDB# 1, 23, 27, 29, 30) to 20,000 (NDDB# 3) individuals per site,
- at least four populations on DOD (or lands transferred from DOD ownership) sites are protected and managed for 1,000 (NDDB# 21 and 31) to 10,000 to 40,000 (NDDB# 2 and 20) individuals per site, and
- populations on DPR lands are protected and managed for 1,000 (NDDB# 4 and 23) to 10,000 (NDDB# 5) individuals per site.

Layia carnosa (beach layia) can be considered for delisting when
- the extended population at Point Reyes National Seashore averages between 5,000 to 10,000 individuals,
- populations on private lands (NDDB# 11 and 27) average 20,000 individuals each,

- the populations with BLM involvement are protected and managed for an average of 1,000 (NDDB# 10), 30,000 (NDDB# 12) and 200,000 (NDDB# 17) individuals, and
- the populations south of the San Francisco region are managed and enhanced to protect 500 individuals per site (NDDB# 3, 4, 5, and 28)

Lupinus tidestromii (Tidestrom's lupine) can be considered for delisting when
- the numbers of individuals in the extended habitat at Point Reyes National Seashore averages 1,000,
- DPR manages an average of 500 individuals in the Monterey region and 500 individuals in the Sonoma region, and
- populations on private lands are protected and enhanced (NDDB# 4, 8, 10, 11, 18, and 19)

Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*) can be considered for delisting when the butterfly is protected and managed at the three known population sites and determined to be stable for at least ten years, as measured by a monitoring program.

B. NARRATIVE OUTLINE FOR RECOVERY ACTIONS ADDRESSING THREATS

1.0 Protect habitat of the listed species and their populations on private lands.

Populations of all listed species on private lands should be secured through conservation easements, conservation agreements, or purchase where there are willing sellers. This is necessary to prevent further declines in distribution and abundance of the listed species from loss and degradation of habitat. The development of cooperative weed control programs will greatly facilitate recovery of these species. Coordination with landowners, local, state, and federal agencies should be taken to ensure that actions are taken to conserve and enhance the populations or habitats for listed species.

1.1 Protect habitat for *Chorizanthe howellii*.

Two populations of *Chorizanthe howellii* ("A" Springer-Sheppard and Ward Avenue populations) occur on private lands within Mendocino County (Table 1).

1.11 Inform landowners

The California Department of Parks and Recreation is knowledgeable of populations under its jurisdiction and can provide local expertise in soliciting voluntary assistance from private landowners for the protection of this species. Landowner contributions to achieve conservation for the species and habitat will assist in providing for successful recovery and delisting the species.

1.12 Consult and inform local lead agencies

The Mendocino County Planning Department should be consulted regarding conservation opportunities for easements, acquisition opportunities, and to determine if there are existing easements. The Planning Department should be informed and made aware of the need to appropriately use and manage land to preserve the plant and its habitat. Populations can be secured using several mechanisms: solicit private land owner participation and support for recovery, establishment of conservation easements by the property owner, voluntary deed restrictions established in perpetuity, permanent resource management easement, or fee acquisition from willing sellers. Support from the local lead agencies for the protection of habitat for the species is essential to be able to recover them.

1.2 Protect habitat for *Chorizanthe pungens* var. *pungens*.

Several known populations of *Chorizanthe pungens* var. *pungens* occur on private lands within Monterey and Santa Cruz counties (Table 3).

90

1.21 Inform land owners

The affected landowners should be informed of the efforts to recover the species and invited to participate in the recovery effort and to prevent the inadvertent destruction of habitat. See task 1.11.

1.22 Consult and inform local lead agencies

The planning departments of Monterey and Santa Cruz County should be consulted to determine what existing easements are in place and to explore opportunities for easements and acquisition. See task 1.12

1.3 Protect habitat for *Lupinus tidestromii*.

Five populations of *Lupinus tidestromii* occur on private lands in Monterey County (Table 9). Two populations are on lands owned by the Pebble Beach Company and the Spanish Bay Company with active management to provide protection for this species (Table 9, NDDB No. 4 and 11). Four populations are on other privately-held lands (Table 9, population No. 3, 8 and 10 and Dillon Beach).

1.31 Inform landowners

Several land owners have existing restoration projects that provide examples of positive cooperation that could be used to solicit support from other landowners in the recovery of the species. See task 1.11

1.32 Consult and inform local lead agencies

The Monterey County Planning Department (populations 3, 8, 10) and Marin County (Dillon Beach population) should be consulted regarding conservation opportunities for easements, acquisition opportunities, and to determine if there are existing easements. See task 1.12.

1.4 Protect habitat for *Layia carnosa*.

Several populations of *Layia carnosa* occur on private lands in Monterey and Humboldt counties (Table 8). Two populations are in Monterey County, one on lands owned by the Pebble Beach Company. One population (Pico Avenue) occurs on private land in the City of Pacific Grove. In Humboldt County, five populations may be on privately held lands. One population is on lands owned by TNC as part of the Lanphere-Christensen Dunes Preserve (population No. 11).

1.41 Inform landowners

See task 1.11

91

1.42 Consult and inform local lead agencies

The Humboldt and Monterey County Planning Departments should be consulted regarding conservation opportunities for easements, acquisition opportunities, and to determine if there are existing easements. See task 1.12.

1.5 Protect habitat for *Gilia tenuiflora* ssp. *arenaria*.

Nine populations of *Gilia tenuiflora* ssp. *arenaria* occur on private lands in Monterey County (Table 4). Two populations are on lands owned by the Pebble Beach Company (populations No. 6 and 11). Another population is on privately-held lands owned by RMC Lonestar Cement Company (Table 4). The other populations are on other private lands, it is not known if the landowners are aware of the presence of these species on their land.

1.51 Inform landowners

See task 1.11.

1.52 Consult and inform local lead agencies

The Monterey County Planning Department should be consulted regarding conservation opportunities for easements, acquisition opportunities, and to determine if there are existing easements. See task 1.12.

1.6 Protect habitat for *Erysimum menziesii*.

Five populations of *Erysimum menziesii* ssp. *menziesii* occur on private lands in Monterey County, in the vicinity of Spyglass Hill, Point Pinos Lighthouse, Signal Hill Road, Bird Rock Road and the Spanish Bay Golf Course (Table 5). In Mendocino County a portion of one population of subspecies *menziesii* occurs on private land in the Ten Mile River area (population No. 4). Presently the owner/manager for the Pudding Creek population (No. 5) is unknown.

Four populations of *Erysimum menziesii* ssp. *eurekense* occur on private lands in Humboldt County (Table 6). One population is on lands owned by TNC and is protected (population No. 1). There are populations on private lands in the vicinity of the south spit at Humboldt Bay (population No. 5) and north of Manila (Samoa Peninsula, population No. 3).

Two populations of *Erysimum menziesii* ssp. *yadonii* occur on private lands in Monterey County and are owned by Lone Star Cement Company (Table 7, population No. 2 and 3).

92

1.61 Inform landowners

See task 1.11

1.62 Consult and inform local lead agencies

The Humboldt and Monterey County Planning departments should be consulted regarding conservation opportunities for easements, acquisition opportunities, and to determine if there are existing easements. See task 1.12

1.7 Protect habitat for Myrtle's silverspot butterfly.

Habitat for the butterfly at the site of the MCGR should be secured and managed to benefit the silverspot (Table 10). This habitat may be secured by agreement with the landowner to protect from development those areas of highest value to the silverspot butterfly. If other privately-owned lands in Marin County and coastal portions of Sonoma County are determined to support populations of the silverspot, they should be secured by agreement with the landowners.

2.0 Minimize threats to the plants and butterfly.

Invasive non-native plant species are immediate biological threats to all of the listed plant species. Invasive plants are also a problem for Myrtle's silverspot (i.e., competition with native larval and adult food plants). The infestations of the invasive plant species need to be controlled.

2.1 Minimize the threats from invasive, non-native plants. Apply control measures.

The removal and control of non-native invasives is one of the most critical requirements to recover the species and their habitats in this plan. Major pests to be controlled are iceplant (*Carpobrotus* spp.), European beachgrass (*Ammophila arenaria)*, broom (*Genista monspessulana*), and yellow bush lupine (*Lupinus arboreus*), as well as others.

2.11 Minimize threats on private lands.

With agreement from private landowners, the infestation of non-native plants should be managed as follows: *Carpobrotus* spp. and *Ammophila* sp. (at numerous locations), *Genista monspessulana* (affecting *Chorizanthe pungens* var. *pungens*), and *Lupinus arboreus* (in Humboldt County, where it is not native). Control measures should be initiated by hand removal, herbicide application, or other effective methods that have proven that minimally affect the listed species.

2.12 Minimize threats on public lands.

Establish or continue programs on publicly-owned lands to control non-native plant infestations. Personnel at PRNS, Marina State Beach, Asilomar State Beach, Sunset State Beach, MacKerricher State Park and Lanphere-Christensen Reserve are implementing management programs to control the spread of invasive non-native species near the known populations of *Chorizanthe valida*, *C. pungens* var. *pungens*, *Erysimum menziesii*, *Layia carnosa*, and *Lupinus tidestromii* (Tables 2, 3, 5, 6, 7, 8 and 9). A more aggressive program to control non-natives on BLM lands needs to be supported by that agency through recognition and funding. Techniques that succeed in enhancing habitats and populations of these listed species should be made available to other managers to augment recovery efforts.

2.2 Deter poaching of Myrtle's silverspot butterfly.

Collecting by unscrupulous individuals was identified as a threat in the final rule for the butterfly and specific efforts may be needed to prevent poaching. Such actions may include regular patrol of known silverspot habitat at PRNS by law enforcement personnel during peak flight days to prevent unauthorized collecting. Support from private land managers to cooperate with the prohibition of take will enhance efforts to recover the species.

3.0 Develop management strategies through a research program to document the listed species' life histories and their ecological and population parameters.

Habitat management for the species in this recovery plan is needed to control the threats to their existence. Data must be obtained to more clearly define and assess recovery.

3.1 Examine the interactions of cattle grazing on the habitat of the listed plant species.

Additional studies (i.e., cattle exclosure studies, seed set studies, population size and density studies) are needed to understand the effects of cattle on these plant species and to determine the best management to achieve recovery objectives.

3.2 Determine spatial and competitive requirements for growth of the listed plant species and the host and nectar plants used by the silverspot butterfly.

Substrate disturbance from recreational uses, such as pedestrian and/or equestrian trails and ORV use, has been reported to result in a decrease in the overall distributions and population sizes of *Chorizanthe howellii*, *C. pungens* var. *pungens*, *Gilia tenuiflora* ssp. *arenaria* and *Layia carnosa*. The amount of open area around *Lupinus tidestromii* has been observed to affect natural regeneration. Preliminary observations of *Chorizanthe pungens* var. *pungens* at Fort Ord (Table 3, population No. 22 and 23) and *Layia carnosa* in Humboldt County (Table 8) suggest that this species occurs in areas with some level of substrate disturbance, such as afforded by low-intensity roadway or recreational use. High- intensity recreational uses, such as uncontrolled ORV use, however, have been documented to cause excessive soil disturbance and habitat loss. Studies need to be conducted to ascertain the relationship between substrate disturbance and the competitive interaction of the invasive species that threaten the open habitat for the listed species and the host and nectar plants used by the silverspot butterfly. Studies of the requirements of each of the listed plant species and the host and nectar plants of the butterfly should be conducted to better understand their specific habitat characteristics.

Suggested studies include recreational exclosure studies that document seed dispersal, germination and other population attributes. These studies are needed to develop guidelines for compatible levels of recreational uses. Opportunities for studies occur at several of the State Parks, Lanphere-Christensen Preserve, BLM lands and at PRNS.

3.3 Study differing management techniques of cattle grazing to improve the habitat of the Myrtle's silverspot butterfly.

Myrtle's silverspot butterfly occurs in separate populations whose long-term persistence may depend upon intercolony movement. The loss of suitable habitat containing larval food plants and adult nectar sources would make movements between populations more difficult. The effect of grazing on the silverspot butterfly and its host plant (*Viola* sp.) requires further study. Intensive grazing could cause the loss of larval food plants and adult nectar sources, however, a managed grazing regime may control the spread of invasive non-native plant species which would ultimately outcompete the larval food plants. Opportunities to conduct such studies may occur at Point Reyes National Seashore.

3.4 Investigate the ecological and limiting factors essential for habitat management and recovery of the silverspot.

Information on the autecology of the silverspot's larval foodplant and its response to both natural successional changes and competition from introduced plants is necessary to develop management plans to maintain viable populations of the silverspot. Some applicable information on this matter may be available from on-going studies of the threatened Oregon silverspot (*S. z. hippolytta*), however, site-specific information may need to be developed for the Myrtle's silverspot.

Like the Oregon silverspot, Myrtle's silverspot visit both native and introduced plants for nectar. The current utilization of non-native thistles as nectar resources should be reduced by managing the habitat for native nectar species. The thistle is an indicator of disturbed habitats and could possibly pose a threat to the integrity of the

95

surrounding native habitat. The replacement of habitat occupied by the thistle with native species will restore the natural habitat and provide essential resources for the Myrtle's silverspot. Those native plant species need to be identified and a restoration plan developed and implemented for outplanting.

3.5 Continue investigation on crucifer rust effects on the Menzies wallflower

The studies that have been initiated on the white crucifer rust affecting the population viability of *Erysimum menziesii* should continue.

4.0 Manage populations and habitats

Management of the listed plant species and their habitat will depend upon information gained from monitoring, threat analysis and the evaluation of protection alternatives. It will be important to involve the expertise of local land owners, land managers, and species experts to develop conservation programs. There may be different management programs for each species. The management program selected will require periodic review to ensure that it is effective in protecting the species.

4.1 Manage *Chorizanthe pungens* var. *pungens* populations.

Develop and implement management practices for *Chorizanthe pungens* var. *pungens* population to ensure conservation of the species.

4.1.1 Establish a working group to collaborate with private and public landowners and appropriate agencies to develop specific management guidelines.

For both publicly and privately-owned populations in Monterey and Santa Cruz counties and Cities of Marina and Sand City, agencies and landowners should collaborate to develop species-specific resource management guidelines. The Service should participate with the Marina Dunes Task Force to collaborate on plans for the Marina Dunes. The City of Sand City should continue to collaborate on plans for the dunes within the City as part of their habitat conservation planning. The DOD and BLM should continue to coordinate on activities within the Naval Postgraduate School and Fort Ord as outlined in the Fort Ord habitat plan. DPR should continue to collaborate on actions at Marina, Sunset, and Asilomar State Beaches.

Working groups should develop site-specific management practices to ensure conservation of the species. This should include the preparation of management guidelines to address control of invasive non-native plant species, insect/disease infestation, potential for reintroduction, buffer zones to non-compatible adjacent land uses, compatible levels of recreational uses, and monitoring strategies.

96

4.1.2 Implement species management guidelines.

Investigate cost-sharing funding mechanisms to implement plan with landowners. This could involve multi-parcel funding and management; funding to implement the management guidelines may also be available through volunteer or donated labor, agency funding or a combination thereof.

4.2 Manage *Chorizanthe howellii* populations.

Develop and implement management practices for *Chorizanthe howellii* populations to ensure conservation of the species.

4.2.1 Establish a working group to collaborate with private and public landowners and appropriate agencies to develop specific management guidelines.

For privately-owned populations in Mendocino County, establish an interagency-landowner(s) collaboration to develop resource management guidelines. The California DPR should continue to work on conserving populations within MacKerricher State Park.

Working groups should develop management practices to ensure conservation of the species. The preparation of management guidelines should address control of invasive non-native plant species, insect/disease infestation, potential for reintroduction, buffer zones to non-compatible adjacent land uses, compatible levels of recreational uses, and monitoring strategies.

4.2.2 Implement species management guidelines.

Seek cost-sharing funding mechanisms to implement plan with landowners. This could involve multi-parcel funding and management. Implementation of the management guidelines may also be possible through volunteer/donated labor, agency funding or a combination thereof.

California DPR should continue to implement management actions at MacKerricher State Park (e.g., Ten Mile Dunes Restoration Plan). These actions include plant/habitat protection, fencing, revegetation and invasive, non-native plant species eradication.

4.3 Manage *Chorizanthe valida* populations.

Develop and implement management practices for *Chorizanthe valida* populations to ensure conservation of the species.

97

4.3.1 Establish a working group to collaborate with the National Park Service (NPS) and appropriate agencies to develop management guidelines.

Establish an interagency collaboration to develop resource management guidelines. The California Native Plant Society Marin Chapter should continue to collaborate on plans for the populations with the California PRNS (Table 2, population No. 2).

The NPS has conducted monitoring of the populations and have conducted grazing exclosure studies. Based upon more detailed grazing studies, develop a grazing policy. Investigate the need for establishing additional populations within suitable habitat areas. Sites should be identified that would be ecologically appropriate for potential introduction in historic localities (Fort Ross, Sebastopol, Petaluma) as well as sites at Point Reyes National Seashore.

4.3.2 Implement species management guidelines.

Investigate cost-sharing funding mechanisms to implement the management plan. This could involve multi-parcel funding and management; funding to implement the management guidelines are expected to continue to be available from volunteer/donated labor, additional agency funding should be pursued.

4.4 Manage *Lupinus tidestromii* populations.

Develop and implement management practices for *Lupinus tidestromii* populations to ensure conservation of the species.

4.4.1 Establish a working group to collaborate with private landowners and appropriate agencies to develop specific management guidelines.

For privately-owned populations, establish an interagency-landowner(s) collaboration to develop resource management guidelines. DPR and NPS should continue to collaborate on plans for the population at Asilomar State Beach and PRNS, respectively.

Working groups should develop management practices to ensure conservation of the species. Preparation of management guidelines should be developed to address control of invasive non-native plant species, insect/disease infestation, potential for artificial regeneration, buffer zones to non-compatible adjacent land uses, compatible levels of recreational uses, and monitoring protocols.

Within PRNS, the populations of *Lupinus tidestromii* (Table 9, population No. 12, 13, 14, 15, 16, and 20) are in areas largely excluded from cattle grazing.

98

Part of a rare plant survey at PRNS recommended reducing grazing on dune areas to protect sensitive habitat and species (Fowler and Fellers 1984). All populations are away from trails. Invasive non-native plants are an increasing threat and some removal has been initiated. Guidelines to monitor encroachment and remove such species should be developed.

4.4.2 Implement species management guidelines.

Investigate cost-sharing funding mechanisms to implement the management plan. This could involve multi-parcel funding and management; funding to implement the management guidelines may also be available through volunteer/donated labor, agency funding or a combination thereof.

4.5 Manage *Layia carnosa* populations.

Develop and implement management practices for *Layia carnosa* populations to ensure conservation of the species.

4.5.1 Establish a working group to collaborate with private landowners and appropriate agencies to develop specific management guidelines

For privately-owned populations, establish an interagency-landowner(s) collaboration to develop resource management guidelines. The Humboldt County Planning Department should continue to work with local landowners, ORV riding clubs, other public agencies and interested citizens to collaborate on plans for protection and management of the species.

Working groups should develop management practices to ensure conservation of the species. Preparation of management guidelines should be developed to address control of invasive non-native plant species, insect/disease infestation, potential for reintroduction, buffer zones to non-compatible adjacent land uses, compatible levels and/or seasonality of recreational uses, and monitoring strategies.

Within PRNS, the populations of *Layia carnosa* are in areas excluded from cattle grazing (Table 8, population No. 7 and 8, and 19 through 26). There is little/no foot traffic; however, invasive non-native plants, including *Ammophila arenaria* and *Carpobrotus* spp. are a likely threat. Guidelines to monitor and control encroachment of such species should be developed.

Within the Humboldt County Beach and Dunes Planning Area, the County has initiated a pilot study to test various sampling techniques for *Layia carnosa* (Table 8, population No. L-1 through L-26). The two major issues for these

99

populations are habitat loss and invasion by *Ammophila arenaria*, *Lupinus arboreus* and *Carpobrotus* spp.

Vandenberg AFB should take immediate steps to conserve seeds from the single, southernmost known locality for the species, and develop specific guidelines for its long-term persistence.

4.5.2 Implement species management guidelines.

Investigate cost-sharing funding mechanisms to implement the management plan. This could involve multi-parcel funding and management; funding to implement the management guidelines may also be available through volunteer/donated labor, agency funding or a combination thereof. Investigate the use of California ORV Division funds for dune restoration, protective fencing, signs and environmental education. The DOD should implement management actions for the population at Vandenberg AFB.

4.6 Manage *Gilia tenuiflora* spp. *arenaria* populations.

Develop and implement management practices for *Gilia tenuiflora* ssp. *arenaria* populations to ensure conservation of the species.

4.6.1 Establish a working group to collaborate with private landowners and appropriate agencies to develop specific management guidelines.

For privately-owned populations, agencies and landowners should collaborate to develop resource management guidelines. The DOD and BLM should continue to coordinate on activities at Fort Ord, as outlined in the Fort Ord habitat plan (Table 4). The DPR should continue to collaborate on actions at Marina, Salinas, and Asilomar State Beaches.

Working groups should develop management practices to ensure conservation of the species. Prepare management guidelines to address control of invasive non-native plant species, insect/disease infestation, potential for reintroduction, buffer zones to non-compatible adjacent land uses, compatible levels of recreational uses, and monitoring strategies.

4.6.2 Implement specific management guidelines.

Investigate cost-sharing funding mechanisms to implement the management plan. This could involve multi-parcel funding and management; funding to implement the management guidelines may also be available through volunteer/donated labor, agency funding or a combination thereof.

Existing plans are being implemented for dune restoration and protection at Marina and Asilomar State Beaches

4.7 Manage *Erysimum menziesii* populations.

Develop and implement management practices for *Erysimum menziesii* populations to ensure conservation of the species.

4.7.1 Establish a working group to collaborate with private landowners and appropriate agencies to develop specific management guidelines.

For privately-owned populations, establish an interagency-landowner(s) collaboration to develop resource management guidelines. In Humboldt County, BLM and TNC should continue to collaborate with the County, State and other Federal agencies on management practices.

Working groups should develop management practices for each parcel to ensure conservation of the species. Prepare management guidelines to address control of invasive non-native plant species, insect/disease infestation, potential for reintroduction, buffer zones to non-compatible adjacent land uses, compatible levels of recreational uses, and monitoring strategies.

Major issues for all the *E. menziesii* populations are habitat loss and invasion by *Ammophila arenaria*, *Lupinus arboreus* (in Humboldt County) and *Carpobrotus* spp.

Utilize existing information by Sawyer (1991) at Humboldt State University and the 1987 plan for Humboldt County populations (Renner *et al.* 1986), to develop parcel-specific actions for *Erysimum menziesii* ssp. *menziesii* and ssp. *eurekense* populations in this region.

4.7.2 Implement specific management guidelines.

Investigate cost-sharing funding mechanisms to implement the management plan. This could involve multi-parcel funding and management; funding to implement the management guidelines may also be available through volunteer/donated labor, agency funding or a combination thereof.

DPR should continue to implement management actions at Marina State Beach (*E. menziesii* ssp. *yadonii*, population No. 5 and 6), Asilomar State Beach (*E. menziesii* ssp. *menziesii*, population No. 7), and MacKerricher State Park (e.g., Ten Mile Dunes Restoration Plan, affecting *E. menziesii* ssp. *menziesii*, Table 5, population No. 4). These actions include plant/habitat protection, fencing, revegetation and eradication of invasive, non-native plant species. TNC should continue to implement actions to eradicate *Lupinus arboreus* from *E. menziesii* ssp. *menziesii* habitat at Lanphere-Christensen Preserve (population No. 1). TNC should continue to monitor the *Erysimum menziesii* populations at the preserve and conduct periodic monitoring of the other populations along Humboldt Bay.

4.8 Manage Myrtle's silverspot butterfly habitat.

Develop and implement management practices for Myrtle's silverspot butterfly populations to ensure conservation of the species.

4.8.1 Establish a working group to collaborate with private landowners and appropriate agencies to develop specific management guidelines.

For privately-owned populations, establish an interagency-landowner(s) collaboration to develop resource management guidelines.

Working groups should develop management practices to ensure conservation of the silverspot, including prescribed/controlled burning, mowing, control of brush and invasive exotic plants, regulation of thatch levels, enhancement of natural seedbeds of *Viola adunca* and native nectar plants.

4.8.2 Implement specific management guidelines.

Investigate cost-sharing funding mechanisms to implement the management plan. This could involve multi-parcel funding and management; funding to implement the management guidelines may also be available through volunteer/donated labor, agency funding or a combination thereof.

5.0 Monitor populations and threats to determine effectiveness of management and to establish delisting criteria.

5.1 Monitor populations to establish trends.

Wide population fluctuations, both spatially and temporally, have been observed within populations of *Chorizanthe valida* and *Layia carnosa*. This may also be true for other listed species; however, data are lacking to confirm this. Studies should be conducted to document population dynamics and cycles in order to determine population sizes for each species. Standard survey methods needs to be used to allow track population data from one year to the next and to be able to compare results between sites.

5.2 Monitor effectiveness of reducing threats.

Standards to measure the success in reducing the levels of threats needs to be developed. This will assist in the determination of the appropriateness to downlist or delist the species that no longer have active, serious threats and review the stability of their dependant habitats.

5.3 Survey likely habitat for additional occurrences of listed taxa.

Recently, new populations have been discovered for several of the listed species. This may be due to an increase in field surveys within potential habitat, and/or an increased awareness of the species due to their regulatory status. Surveys may find additional populations. When discoveries are made it is the responsibility of the survey biologists should report those occurrences, preferably within two months, to the California Department of Fish and Game's Natural Diversity Data Base.

6.0 Coordinate recovery actions to protect other listed species and species of special concern.

Other rare and endangered wildlife species occur within the ranges of the seven listed plant species. Management actions, such as the removal of invasive non-native plant species through herbicide application, may affect these species. Management actions should avoid adverse impacts to these species and their habitat.

• The Smith's blue butterfly (*Euphilotes enoptes smithi*) is Federally listed as endangered. The species typically occurs in fore and rear sand dunes in the Monterey Bay region. South of the Carmel River the species also occurs in grassland and coastal scrub and the interface between these two habitat types. Recovery actions for *Chorizanthe pungens* var. *pungens*, *Layia carnosa*, *Lupinus tidestromii*, *Gilia tenuiflora* ssp. *arenaria*, and *Erysimum menziesii* may affect the Smith's blue butterfly where they co-exist. Management actions involving Federal funding or permits must be coordinated with the U.S. Fish and Wildlife Service, Ventura, California.

• The western snowy plover (*Charadrius alexandrinus nivosus*) is listed as threatened by the Service. Nesting habitat occurs along sandy beaches and might overlap with *Chorizanthe pungens* var. *pungens*, *Gilia tenuiflora* ssp. *arenaria*, *Erysimum menziesii*, *Layia carnosa*, and *Lupinus tidestromii*. Recovery actions for those species may affect the western snowy plover where they co-exist. Management actions involving Federal funding or permits must be coordinated with the U.S. Fish and Wildlife Service, Ventura or Sacramento, California. Management actions should be coordinated with Service biologists from the Ventura and Sacramento Fish and Wildlife Offices.

The following species are of conservation concern, although they are not Federally or state listed.

- The Point Reyes blue butterfly *(Icaricia icarioides)* occurs in fore and rear dunes in the Point Reyes area. The species pupate in ground and their larval food is *Lupinus chamissonis*. Recovery actions for *Chorizanthe valida* and *Layia carnosa* may affect the Point Reyes blue butterfly where they co-exist.

- The Marin elfin butterfly (*Incisalia mossii*) inhabits the Dillon Beach area of Marin County where it inhabits rock outcrops and bluffs. Its larval food is *Sedum spathulifolium*. Recovery actions for *Chorizanthe valida* and *Layia carnosa* may affect the Point Reyes blue butterfly where they co-exist.

- Monterey dunes scorpion (*Pauroctonus maritimus*) occurs in sand dunes in the Monterey Bay area. Recovery actions for *Chorizanthe pungens* var. *pungens*, *Layia carnosa*, *Lupinus tidestromii*, *Gilia tenuiflora* ssp. *arenaria*, and *Erysimum menziesii* may affect the Smith's blue butterfly where they co-exist.

- Point Reyes horkelia (*Horkelia marinensis*) occurs on sandy flats near the coast from the vicinity of Fort Bragg to Santa Cruz County. Recovery actions for *Chorizanthe valida*, *Chorizanthe pungens* var. *pungens*, *Layia carnosa*, *Lupinus tidestromii*, *Gilia tenuiflora* ssp. *arenaria*, and *Erysimum menziesii* may affect Point Reyes horkelia where they co-exist.

- Gairdner's yampah (*Perideridia gairdneri* ssp. *gairdneri*) occurs in coastal flats from Sonoma County to Monterey County. Recovery actions for *Chorizanthe valida*, *Chorizanthe pungens* var. *pungens*, *Layia carnosa*, *Lupinus tidestromii*, *Gilia tenuiflora* ssp. *arenaria*, and *Erysimum menziesii* may affect Gairdner's Yampah where they co-exist.

7.0 Develop and implement an outreach program.

Increasing public awareness of the seven endangered plant species and the Myrtle's silverspot butterfly will facilitate efforts to preserve these species and their habitats. Prepare and distribute informational brochures and audio-visual and sign programs on preservation and recovery. Through the cooperative interagency working groups, prepare brochures and audio-visual materials that describe the plight of the listed species and the regional efforts being undertaken for their recovery. Disseminate the brochures to affected landowners and other community facilities (e.g., MCGR). Provide the audio-visual materials to public facilities, such as park interpretive programs and school programs (e.g., MCGR). Prepare interpretive educational signs for PRNS and other locations.

C. LITERATURE CITED

Arnold, R.A. 1990. Candidate insect surveys at Marin Coast Golf Ranch site. Unpublished report to Harding Lawson Associates, Novato, Calif.

Barbour, M.G. and A.F. Johnson. 1988. Beach and Dune. Pp. 223-261. *In:* M.G. Barbour and J. Major (eds.). Terrestrial Vegetation of California. CNPS Special Publ. No. 9.

Bentham, G. 1836. Trans. Linn. Soc. London 17:419.

Botanica Northwest Associates. 1992. Monitoring Plan for Menzies' Wallflower (*Erysimum menziesii*) in the Humboldt County Beach and Dunes Planning Area. Unpublished draft report, August, 1992.

California Department of Fish and Game. 1985a. California native plant status report, *Chorizanthe howellii*. CDFG Endangered Plant Program and CNPS Rare Plant Program.

California Department of Fish and Game. 1985b. California native plant status report, *Lupinus tidestromii* var. *tidestromii*. CDFG Endangered Plant Program and CNPS Rare Plant Program.

California Native Plant Society. 1980. Marin Chapter newsletter, September 1980. 7(1).

Clark, R.A. and G.M. Fellers. 1986. Rare plants of Point Reyes National Seashore. Cooperative National Park Resources Studies Unit. Tech. Rpt. No. 22. University of California, Davis.

Collins, N.M. and M.G. Morris. 1985. Threatened swallowtail butterflies of the world. The IUCN Red Data Book. International Union for Conservation of Nature and Natural Resources, Gland, Switzerland.

Cooper, W.S. 1967. Coastal dunes of California. Geol. Soc. Amer. Mem. 104:1-125.

Cowan, B. 1994. Dune restoration, Naval Postgraduate School. Unpublished report, U.S. Fish and Wildlife Service.

Davis, L. 1988a. Rare plant status of Lunny Ranch, south of and bordering Abbott's Lagoon. Report to Bill Shook, Resource Management Specialist, Pt. Reyes National Seashore.

Davis, L. 1988b. Letter to Dr. James Reveal, University of Maryland, dated 12 October 1988.

Davis, L 1988c Management recommendation on Abbott's Lagoon Report submitted 20 October 1938 to Pt Reyes National Seashore park management

Davis, L and R J Sherman 1990 The rediscovered Sonoma spineflower at Point Reyes National Seashore Fremontia 18(1):17-18

Department of Parks and Recreation 1991 Letter to Wayne White, USFWS Dated May 21, 1991

Department of the Interior, Fish and Wildlife Service (see U S Fish and Wildlife Service)

Dorrell-Canepa, Joey 1992 Annual Report on *Gilia tenuiflora* ssp *arenaria* Prepared for Calif Dept of Fish and Game Sacramento, CA [not cited in text]

Dorrell-Canepa, Joey 1994 An Autoecological Study of *Gilia tenuiflora* ssp *arenaria* Prepared for Calif Dept of Fish and Game Sacramento, CA

dos Passos, C F and L P Grey 1945 A new species and some new subspecies of *Speyeria* (Lepidoptera, Nymphalidae) Amer Mus No 1297

Duebendorfer, T 1985 Habitat Survey of *Erysimum menziesii* on the North Spit of Humboldt Bay Unpublished report, Humboldt County Public Works Dept Eureka, Calif [not cited in text]

Eastwood, A 1938 The perennial lupines of California, Part I Leafl W Bot 2:86

Ertter, B 1990 Report on the results of a panel to evaluate the taxonomic validity of *Chorizanthe robusta* var *hartwegii* Unpublished report submitted to the U S Fish and Wildlife Service

Ferreira, J 1989 Project status report on dune restoration at Sunset State Beach Unpublished report no 219-410-01-04 CDFG

Ferris, R S 1960 Illustrated flora of the Pacific states Vol IV Stanford Univ Press

Fowler, R C and G M Fellers 1984 Rare plants of Point Reyes National Seashore Unpublished report

Gall, L F 1984 Population structure and recommendations for conservation of the narrowly endemic alphin butterfly, *Boloria acrocnema* (Lepidoptera Nymphalidae) Biol Cons 28:111-138

Goodman, G.L. 1934. A revision of the North American species of the genus *Chorizanthe*. Annals of the Missouri Botanical Garden 21:44.

Grant, Verne and Alva Day Grant. 1956. Cobwebby Gilias. El Aliso 3:3(246-247).

Greene, E.L. 1892. Studies in the Compositae. Pittonia 2:244-248.

Greene, E.L. 1895. Novitates occidentales-X. Erythea 3:17.

Hickman, J.C. (ed.). 1993. The Jepson Manual Higher Plants of California. Berkeley: Univ. of Calif. Press.

Howe, W.H. 1975. The Butterflies of North America. Doubleday & Co., Inc. Garden City, NY. 633 pp.

Launer, A.E. and D.D. Murphy. 1993. Field studies and management recommendations for Myrtle's silverspot butterfly at Point Reyes National Seashore. Center for Conservation Biology, Stanford University. [not cited.]

Launer, A.E. and D.D. Murphy. 1994. The decline of Myrtle's silverspot butterfly. Tideline 14(1):1-3 [not cited]

Launer, A.E., D.D. Murphy, J.M. Hoekstra, and H.R. Sparrow. 1992 (1994). The endangered Myrtle's silverspot butterfly: present status and initial conservation planning. J. of Res. on the Lepidoptera 31(1-2):132-146.

Munz, P.A. 1958. California miscellany IV. Aliso 4:92.

Munz, P.A. and D.D. Keck. 1959. A California Flora. Univ. Calif. Press, Berkeley.

Murphy, D.D. 1988. Are we studying our endangered butterflies to death? J. Res. Lepidoptera 26(104):236-239.

Murphy, D.D. 1991. Report on the status of Myrtle's silverspot butterfly, *Speyeria zerene myrtleae*, at the proposed Marin Coast Golf Ranch site and in surrounding areas. Unpublished report. Center for Conservation Biology, Stanford Univ., Stanford, CA. [not cited. Same as Murphy and Launer 1991, which is cited but doesn't appear in Literature Cited?]

NDDB. 1996. Natural Diversity Data Base. California Department of Fish and Game.

Norris, Virginia. 1988. CNDDB Field Survey Form, submitted to CNDDB, May 27, 1988, Sacramento, CA [only cited in text as "in litt"]

107

Nuttall, T. 1841. Descriptions of new species and genera of plants in the natural order of the Compositae. Amer. Phil. Soc. Trans. II 7:283-453.

Parry, C. 1889. Proc. Davenport Acad. Nat. Sci. 5:175.

Pickart, Andrea. 1988. 1988 Monitoring Report for Menzies' Wallflower (*Erysimum menziesii*) at the Lanphere-Christensen Dunes Preserve.

Pickart, A., L. Miller, and T. Duebendorfer. 1990. An integrated approach to enhancing rare plant populations through habitat restoration III. Restoration of altered coastal dunes. Pgs. 478-487 *in* H. Hughs and T. Bonnicksen, eds. Restoration 89; The new management challenge. Society fo Ecological Restoration, Madison, Wisconsin.

Price, R.A. 1986. Letter to Ken Berg, Humboldt State University Herbarium, dated May 12, 1986. [not cited]

Price, R.A. 1987. Systematics of the *Erysimum capitatum* alliance (Brassicaceae) in North America. Ph.D. Dissertation, Univ. Calif., Berkeley.

Renner, M.A. (ed.), K. Berg, K.L. Clark, T. Duebendorfer and G.A. Newton. 1986. Draft Menzies' Wallflower Dunes Mitigation Bank Enhancement Plan, Monitoring Plan, Implementation Schedule. Unpublished technical report, September 15, 1986. [cited as 1987 in text. This is presumably the correct citation]

Reveal, J.L. and C.B. Hardham. 1989. A revision of the annual species of *Chorizanthe* (Polygonaceae: Eriogonoideae). Phytologia 66(2):98-198.

Sawyer, J.O., Jr. 1991. The Menzies Wallflower Research Program. Unpublished report. Humboldt State University Department of Biological Science, Arcata, California.

Sawyer, J.O. and T. Keeler-Wolf. 1995. A manual of California Vegetation. California Native Plant Society.

Scott, J.A. 1986. The butterflies of North America. Stanford University Press, Stanford, CA.

Singer, M.C. and P.D. Wedlake. 1981. Capture does affect probability of recapture in a butterfly species. Ecological Entomology 6:215-216.

Thomas Reid Associates. 1987. Marina Dunes Plan, Supporting Technical Studies. Prepared for Marina Coastal Zone Planning Task Force. Palo Alto, CA.

Torrey, J. and A. Gray. 1843. Fl. N. Amer. 2:394.

U.S. Army Corps of Engineers (COE), Sacramento District. 1992. Flora and fauna baseline study of Fort Ord, California. With technical assistance from Jones & Stokes Associates, Inc. (JSA 90-214). Sacramento, Calif.

U.S. Army Corps of Engineers (COE), Sacramento District. 1993. Installation-wide Multispecies Habitat Management Plan for Fort Ord, California. Sacramento, CA. [not cited]

U.S. Fish and Wildlife Service. 1992. Endangered and threatened wildlife and plants: six plants and Myrtle's silverspot butterfly from coastal dunes in northern and central California determined to be endangered. *Federal Register* 57 (120): 27848-27859.

U.S. Fish and Wildlife Service. 1994. Endangered and Threatened Wildlife and Plants: Endangered Status for Three Plants and Threatened Status for One Plant from Sandy and Sedimentary Soils of Central Coastal California. *Federal Register* 59(24): 5499-5510.

Zoger, A. and B. Pavlik. 1987. Marina Dunes rare plant survey. Report prepared for Marina Coastal Zone Planning Task Force.

III. IMPLEMENTATION SCHEDULE

PRIORITY NO	TASK NO	TASK DESCRIPTION	DURATION (YEARS)	RESPONSIBLE PARTY	TOTAL COST	COST ESTIMATES (in thousands of dollars) YR1	YR2	YR3	YR4	YR5
Need 1.	**Protect existing populations and habitats**									
1	1.11	Inform land owners--*Chorizanthe pungens* var. *pungens*	3	FWS	10	2	2	2	2	2
1	1.12	Consult agencies--*Chorizanthe pungens* var. *pungens*	ongoing	FWS/VFO	10	2	2	2	2	2
1	1.21	Inform land owners--*Chorizanthe howellii*	3	FWS/SFO	10	2	2	2	2	2
1	1.22	Consult agencies--*Chorizanthe howellii*	ongoing	FWS/SFO	10	2	2	2	2	2
1	1.31	Inform land owners--*Lupinus tidestromii*	3	FWS/SFO	10	2	2	2	2	2
1	1.32	Consult agencies--*Lupinus tidestromii*	ongoing	FWS/SFO	10	2	2	2	2	2
1	1.41	Inform land owners--*Layia carnosa*	3	FWS/SFO	10	2	2	2	2	2
1	1.42	Consult agencies--*Layia carnosa*	ongoing	FWS/SFO	10	2	2	2	2	2
1	1.51	Inform land owners--*Gilia tenuiflora* ssp. *arenaria*	3	FWS/VFO	10	2	2	2	2	2
1	1.52	Consult agencies--*Gilia tenuiflora* ssp. *arenaria*	ongoing	FWS/VFO	10	2	2	2	2	2
1	1.61	Inform land owners--*Erysimum menziesii*	3	FWS/SFO/VFO	11	3	2	2	2	2
1	1.62	Consult agencies--*Erysimum menziesii*	ongoing	FWS/SFO/VFO	10	2	2	2	2	2
1	1.7	Protect Myrtle's silverspot butterfly habitat	5(+)	TBD(PRIVATE)	0	0	0	0	0	0
1	6	Protect other listed & sensitive taxa	ongoing	TBD(AGENCY & PRIVATE)	5	1	1	1	1	1
		NEED 1 SUBTOTALS			**126**	**26**	**25**	**25**	**25**	**25**
Need 2.	**Establish active management for the reduction of non-native invasive plant species. Minimize threats**									
1	2.11	Minimize invasive plant threats on private land	5(+)	PLO	25	5	5	5	5	5
1	2.12	Minimize invasive plant threats on public lands	5(+)	AGENCIES	100	20	20	20	20	20
1	2.2	Deter poaching--silverspot	ongoing	AGENCIES	10	2	2	2	2	2
		NEED 2 SUBTOTALS			**135**	**27**	**27**	**27**	**27**	**27**

PRIORITY	TASK		DURATION	RESPONSIBLE	TOTAL	COST ESTIMATES (in thousands of dollars)				
NO	NO	TASK DESCRIPTION	(YEARS)	PARTY	COST	YR1	YR2	YR3	YR4	YR5
Need 3.	**Develop management strategies**									
1	3.1	Investigate grazing effects on plant habitat	5	TBD	25	5	5	5	5	5
1	3.3	Investigate grazing effects on Myrtle's silverspot butterfly	5	TBD	25	5	5	5	5	5
2	3.2	Determine habitat requirements for plants	5	TBD	25	5	5	5	5	5
2	3.4	Determine habitat requirements for butterfly	5	FWS	25	5	5	5	5	5
				TBD	25	5	5	5	5	5
2	3.5	Investigate crucifer rust for *Eyrsimum menziesii*	5	BLM,FWS, INC	25	5	5	5	5	5
		NEED 3 SUBTOTALS			**150**	**30**	**30**	**30**	**30**	**30**
Need 4.	**Manage populations and habitats**									
2	4.11	Establish working group--*Chorizanthe pungens*	3	FWS	20	10	5	5	0	0
2	4.12	Implement guidelines--*Chorizanthe pungens*	4	TBD	25	0	5	10	5	5
2	4.21	Establish working group--*Chorizanthe howellii*	3	FWS	20	10	5	5	0	0
2	4.22	Implement guidelines--*Chorizanthe howellii*	4	TBD	25	0	5	10	5	5
2	4.31	Establish working group--*Chorizanthe valida*	3	FWS, NPS	20	10	5	5	0	0
2	4.32	Implement guidelines--*Chorizanthe valida*	4	TBD	25	0	5	10	5	5
2	4.41	Establish working group--*Lupinus tidestromii*	3	FWS	20	10	5	5	0	0
2	4.42	Implement guidelines--*Lupinis tidestromii*	4	TBD	25	0	5	10	5	5
2	4.51	Establish working group--*Layia carnosa*	3	FWS	20	10	5	5	0	0
2	4.52	Implement guidelines--*Layia carnosa*	4	TBD	25	0	5	10	5	5
2	4.61	Establish working group--*Gilia tenuiflora* ssp. *arenaria*	3	FWS	20	10	5	5	0	0
2	4.62	Implement guidelines--*Gilia tenuiflora* ssp. *arenaria*	4	TBD	25	0	5	10	5	5
2	4.71	Establish working group--*Erysimum menziesii*	3	FWS	20	10	5	5	0	0
2	4.72	Implement guidelines--*Erysimum menziesii*	4	TBD	25	0	5	10	5	5
2	4.81	Establish working group--Silverspot	3	FWS	20	10	5	5	0	0
2	4.82	Implement guidelines--Silverspot	4	TBD	25	0	5	10	5	5

PRIORITY NO.	TASK NO.	TASK DESCRIPTION	DURATION (YEARS)	RESPONSIBLE PARTY	TOTAL COST	COST ESTIMATES (in thousands of dollars) YR1	YR2	YR3	YR4	YR5
		NEED 4 SUBTOTALS			**360**	**80**	**80**	**120**	**40**	**40**
Need 5.	**Monitor populations and threats.**									
3	5.1	Monitor populations--trends	5	TBD	25	5	5	5	5	5
				FWS	5	1	1	1	1	1
3	5.2	Monitor success at reducing threats	5	TBD	25	5	5	5	5	5
				FWS	5	1	1	1	1	1
3	5.3	Survey likely habitat	ongoing	TBD	25	5	5	5	5	5
				FWS	5	1	1	1	1	1
		NEED 5 SUBTOTALS			**90**	**18**	**18**	**18**	**18**	**18**
Need 6.	**Coordinate recovery actions to protect other listed and sensitive species.**									
3	6	Protect other listed and sensitive species	ongoing	FWS	5	1	1	1	1	1
				AGENCIES	5	1	1	1	1	1
		NEED 6 SUBTOTALS			**10**	**2**	**2**	**2**	**2**	**2**
Need 7.	**Develop and implement outreach program**									
3	7	Outreach program	ongoing	TBD	25	5	5	5	5	5
				FWS	5	1	1	1	1	1
		NEED 7 SUBTOTALS			**30**	**6**	**6**	**6**	**6**	**6**
		TOTAL COSTS			**901**	**189**	**188**	**228**	**148**	**148**

PRIORITY NO	TASK NO	TASK DESCRIPTION	DURATION (YEARS)	RESPONSIBLE PARTY	TOTAL COST	COST ESTIMATES (in thousands of dollars)				
						YR1	YR2	YR3	YR4	YR5

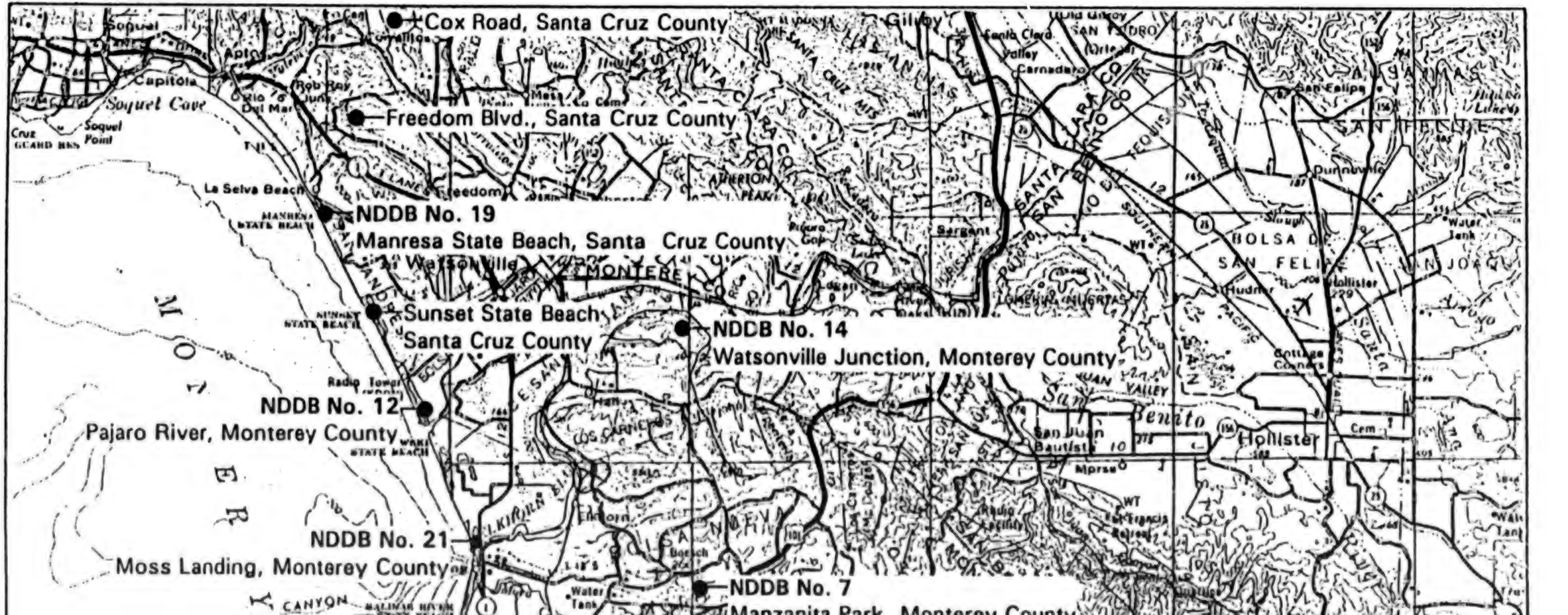
Key to abbreviations:

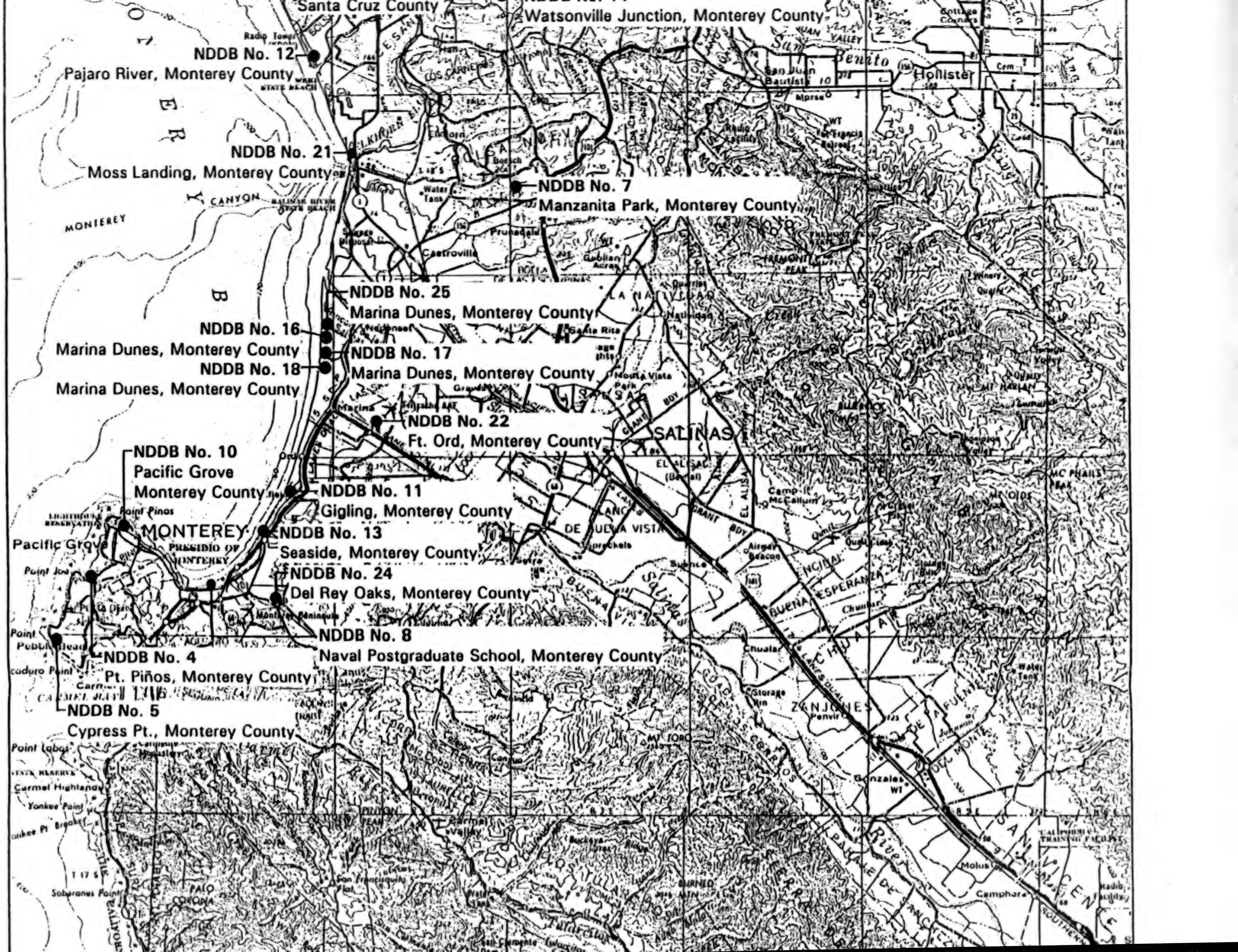
FWS	U.S. Fish and Wildlife Service
VFO	U.S. Fish and Wildlife Service (Ventura Field Office)
SFO	U.S. Fish and Wildlife Service (Sacramento Field Office)
PLO	Private Land Owners
TBD	To be determined
NPS	National Park Service
BLM	Bureau of Land Management
ACOE	Army Corps of Engineers
WG	Working Group
ongoing	To continue until the action is no longer necessary for recovery
	Refers to the local lead agencies with planning authority for actions that may affect

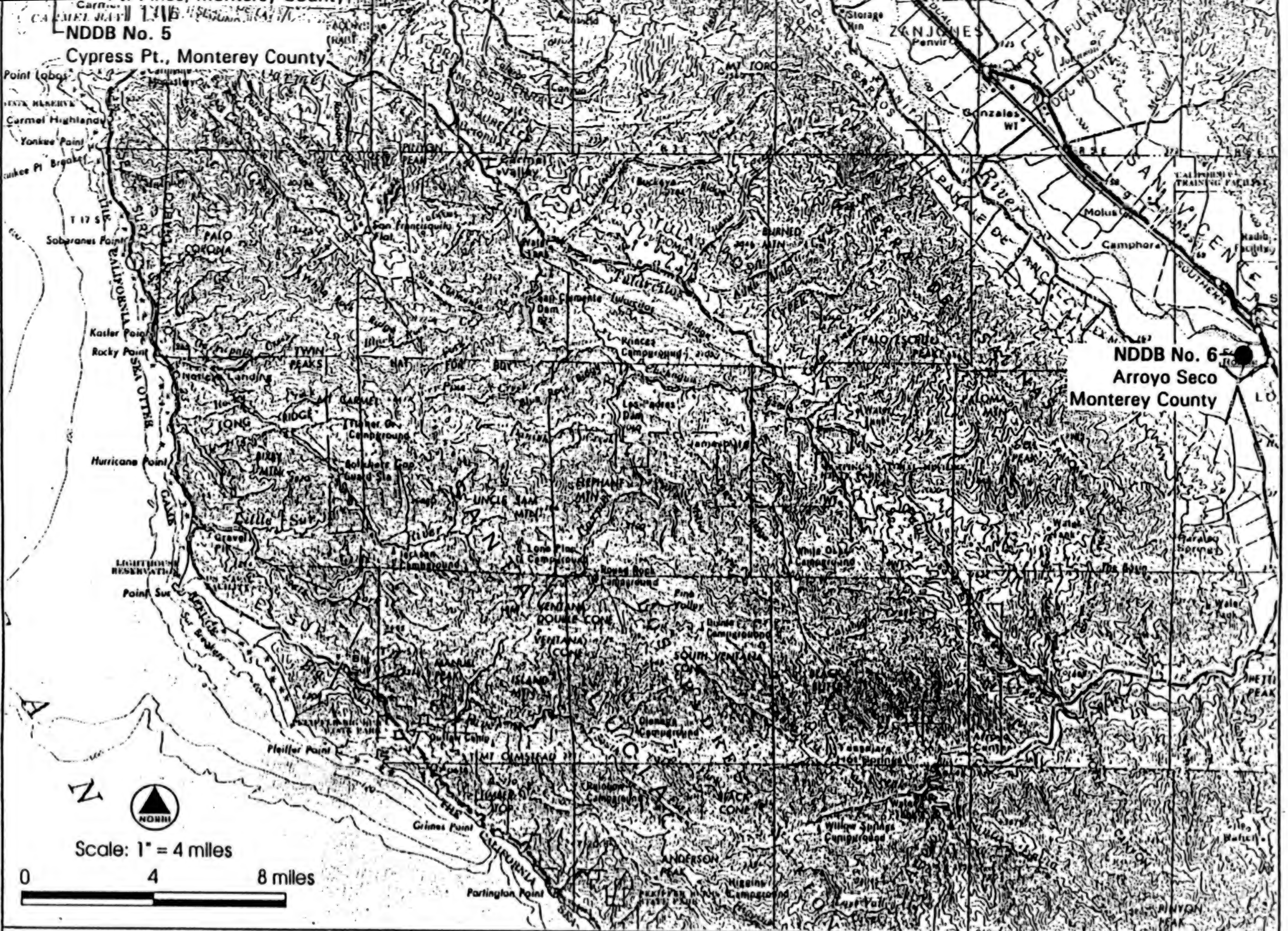
END

DATE FILMED

08/27/98


Cox Road, Santa Cruz County
Freedom Blvd., Santa Cruz County
NDDB No. 19
Manresa State Beach, Santa Cruz County
Sunset State Beach
Santa Cruz County
NDDB No. 14
Watsonville Junction, Monterey County
NDDB No. 12
Pajaro River, Monterey County
NDDB No. 21
Moss Landing, Monterey County
NDDB No. 7
Soquel
Aptos
Capitola
Soquel Cove
Soquel Point
La Selva Beach
Watsonville
Gilroy
Hollister
San Juan Bautista
Dunneville
BOLSA DE SAN FELIPE
Elkhorn
MONTEREY


Santa Cruz County
Watsonville Junction, Monterey County
NDDB No. 12
Pajaro River, Monterey County
NDDB No. 21
Moss Landing, Monterey County
NDDB No. 7
Manzanita Park, Monterey County
NDDB No. 25
Marina Dunes, Monterey County
NDDB No. 16
Marina Dunes, Monterey County
NDDB No. 17
Marina Dunes, Monterey County
NDDB No. 18
Marina Dunes, Monterey County
NDDB No. 22
Ft. Ord, Monterey County
NDDB No. 10
Pacific Grove
Monterey County
NDDB No. 11
Gigling, Monterey County
NDDB No. 13
Seaside, Monterey County
NDDB No. 24
Del Rey Oaks, Monterey County
NDDB No. 8
Naval Postgraduate School, Monterey County
NDDB No. 4
Pt. Piños, Monterey County
NDDB No. 5
Cypress Pt., Monterey County
MONTEREY
SALINAS
Hollister
Castroville
Pacific Grove
Point Pinos
MONTEREY
CANYON
San Juan Bautista
Marina
Gonzales
Chualar
Point Lobos
Carmel Highlands
Yankee Point
Soberanes Point
PRESIDIO OF MONTEREY
FREMONT PEAK
Spreckels



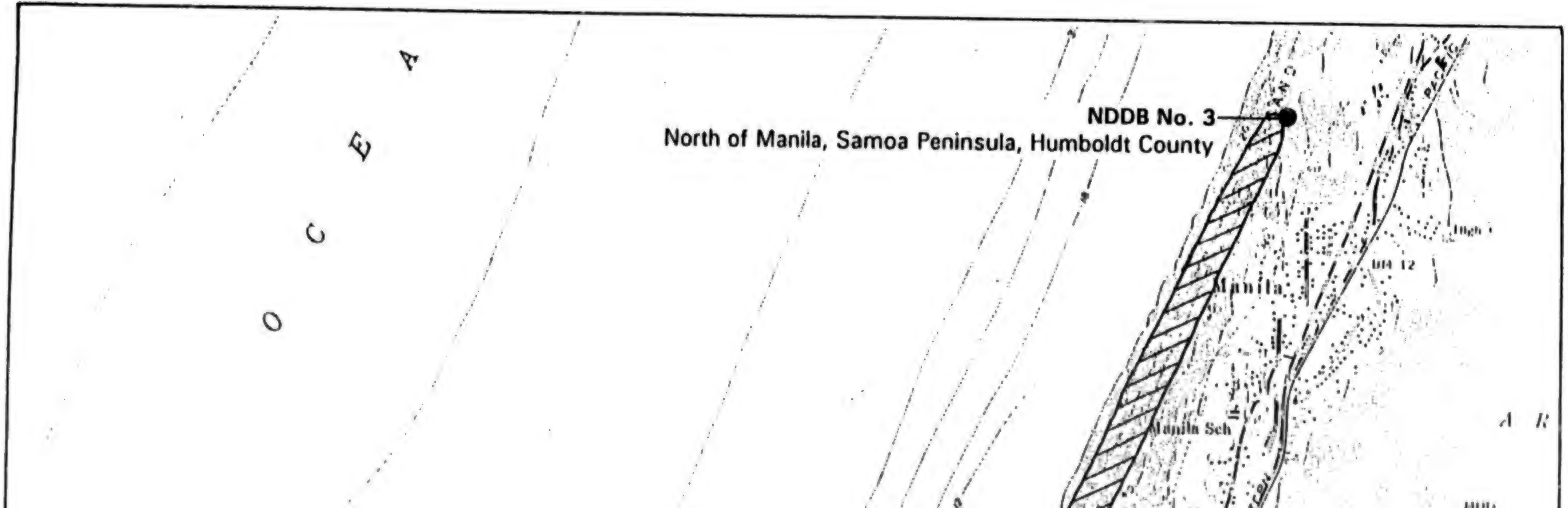
Approximate Distribution of
Chorizanthe pungens var. *pungens*
RECOVERY PLAN

FIGURE 4

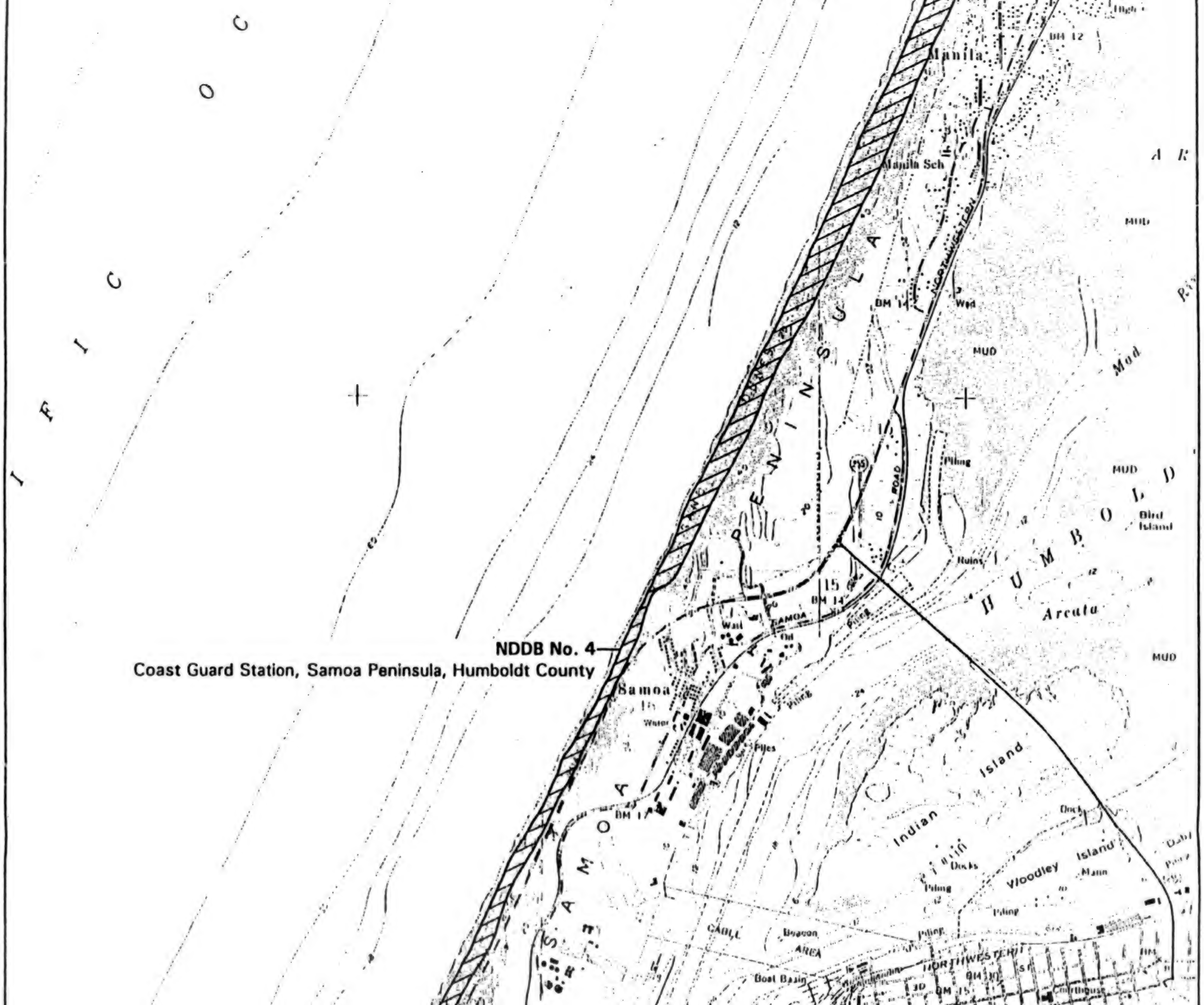
Approximate Distribution of
Chorizanthe pungens var. *pungens*
RECOVERY PLAN

FIGURE 4

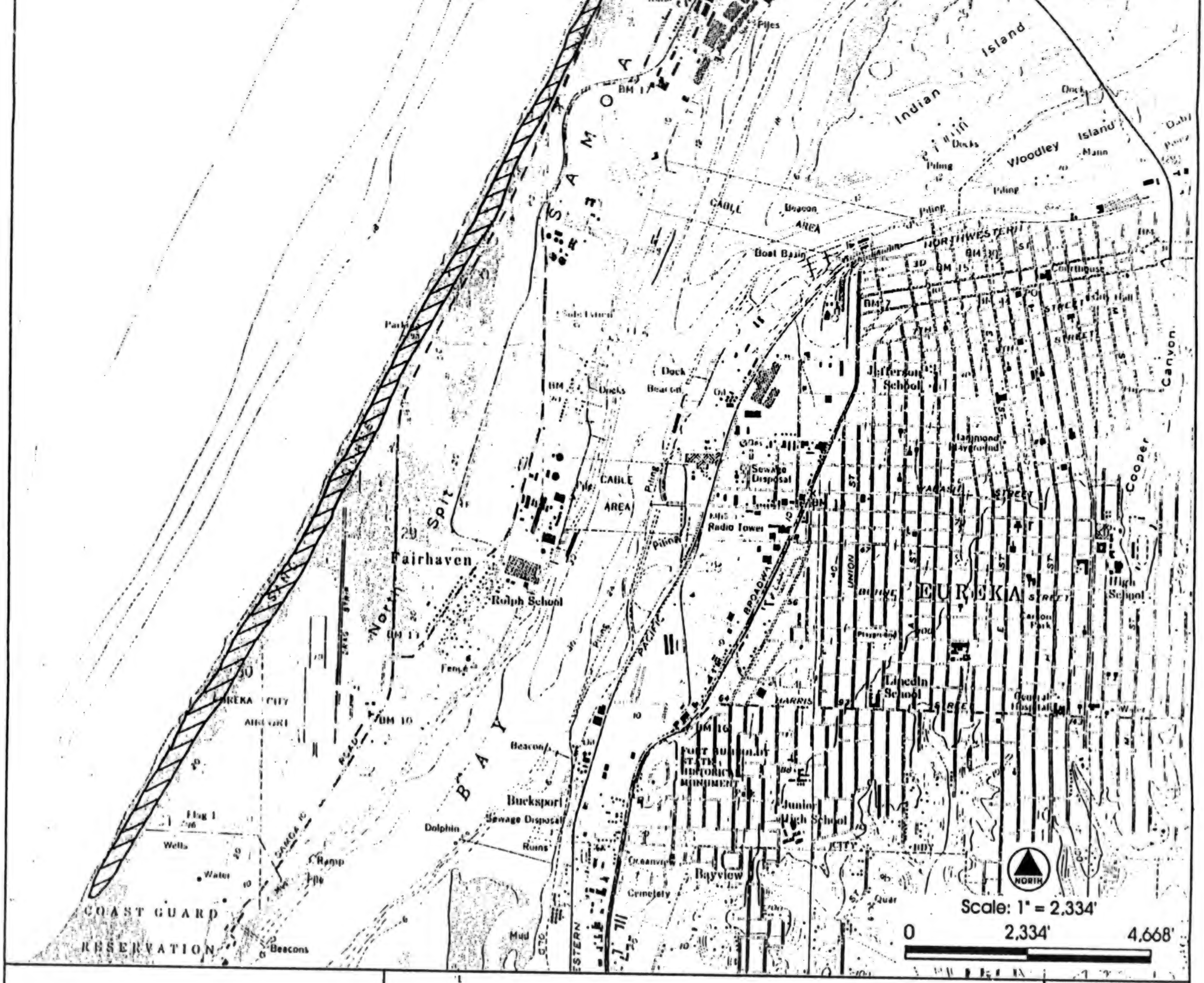
BEST COPY AVAILABLE



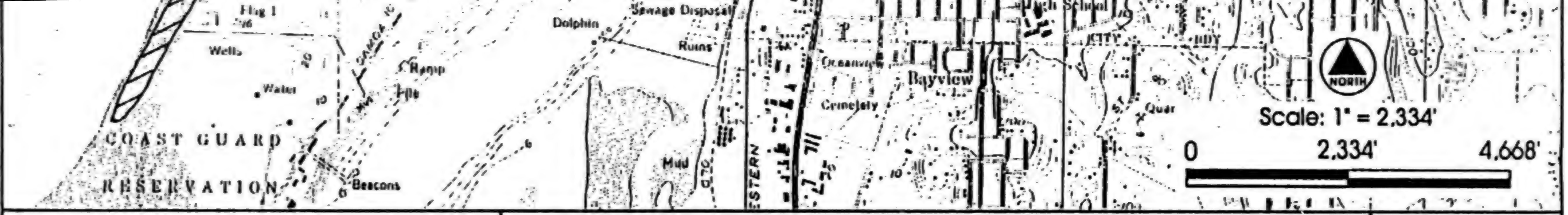
NDDB No. 3
North of Manila, Samoa Peninsula, Humboldt County



NDDB No. 4
Coast Guard Station, Samoa Peninsula, Humboldt County



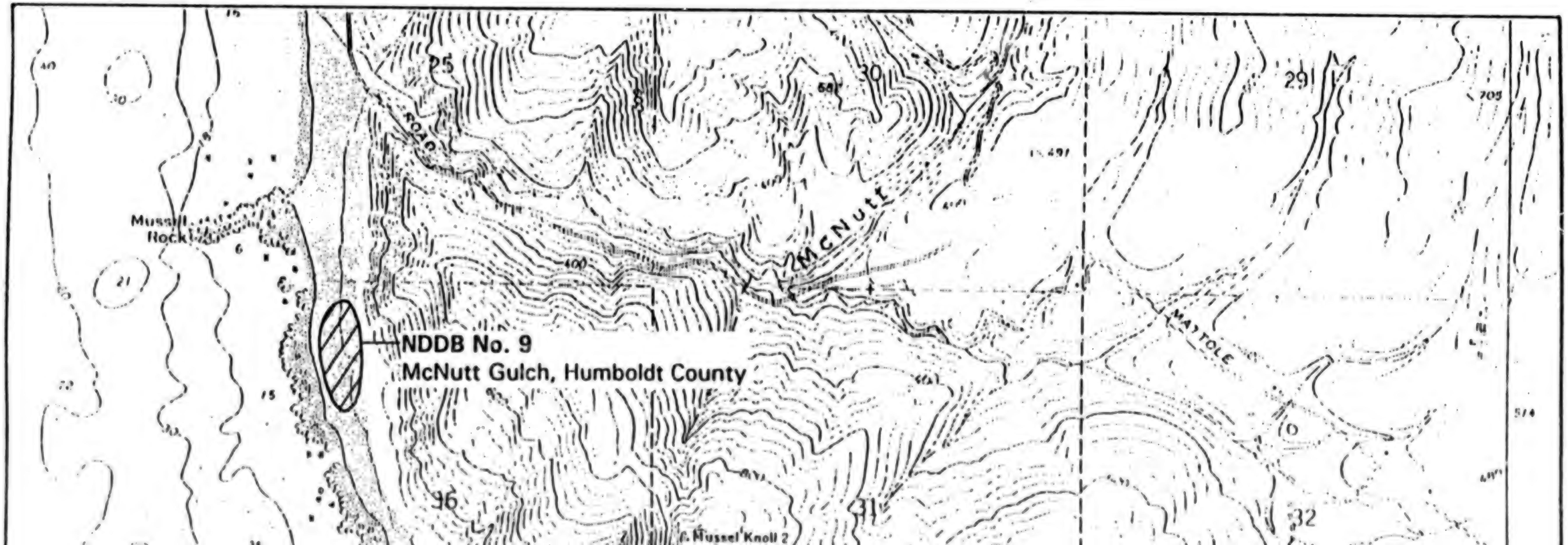
Approximate Distribution of



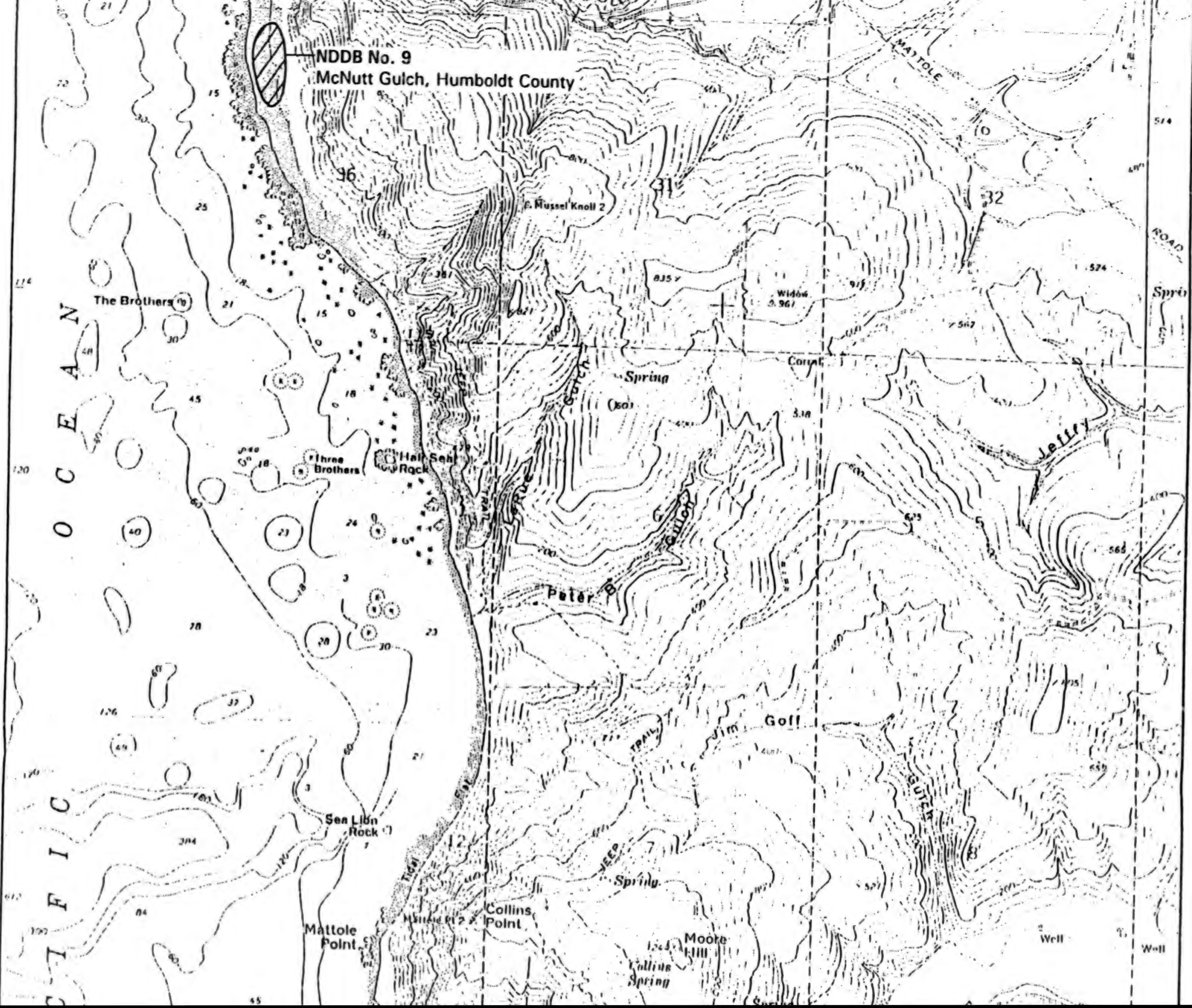
Approximate Distribution of
Erysimum menziesii ssp. *eurekense*
RECOVERY PLAN

FIGURE 11

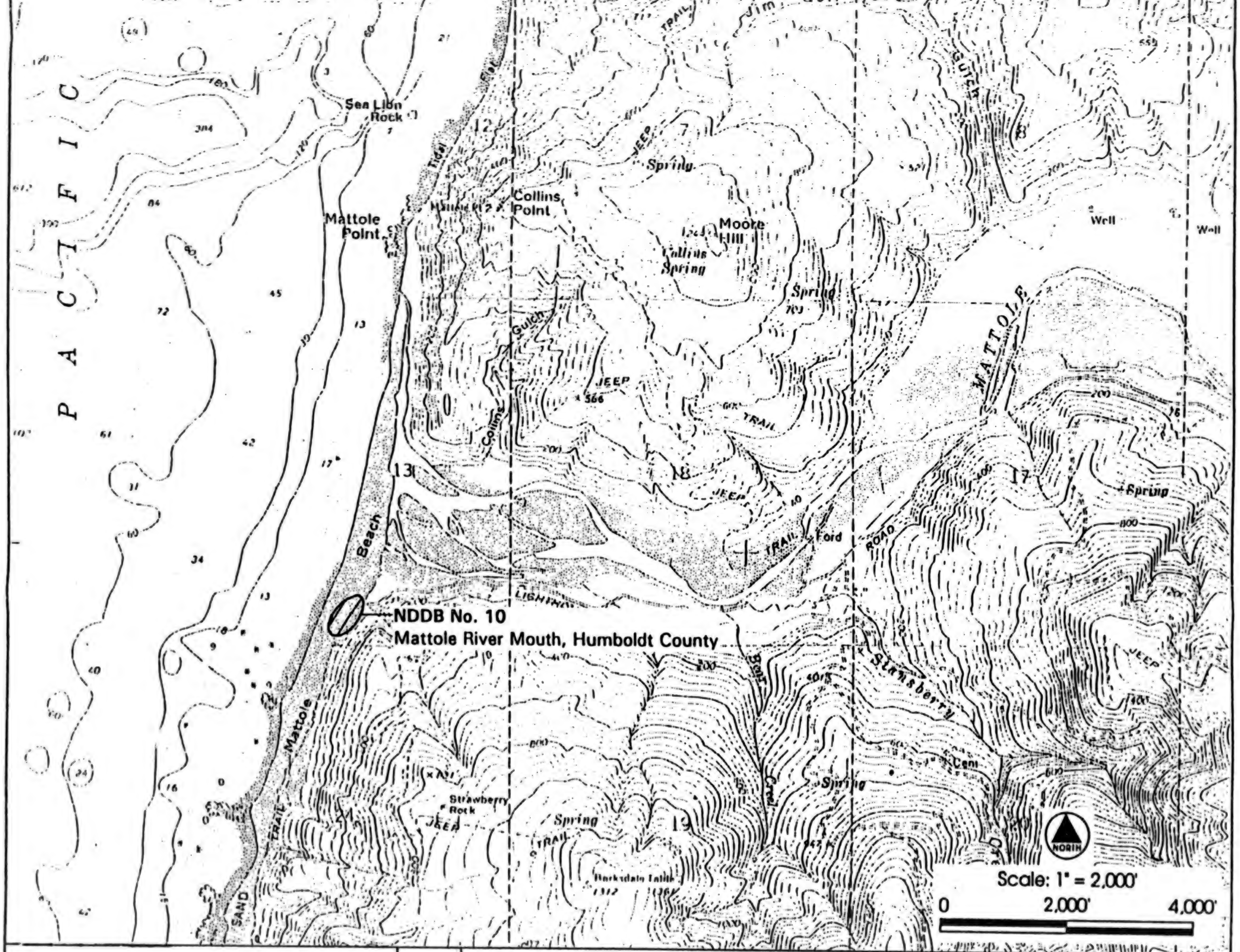
BEST COPY AVAILABLE



NDDB No. 9
McNutt Gulch, Humboldt County

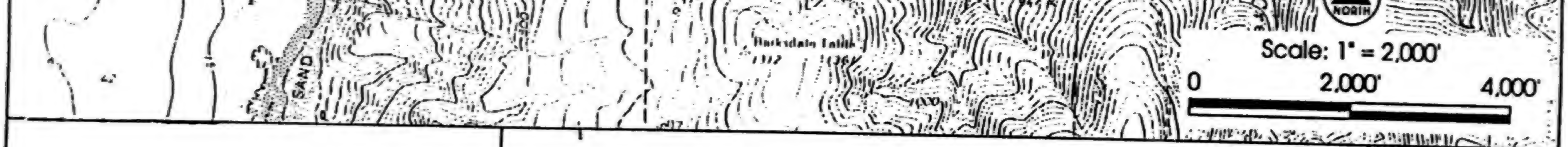


NDDB No. 9
McNutt Gulch, Humboldt County



Approximate Distribution of
Layia carnosa

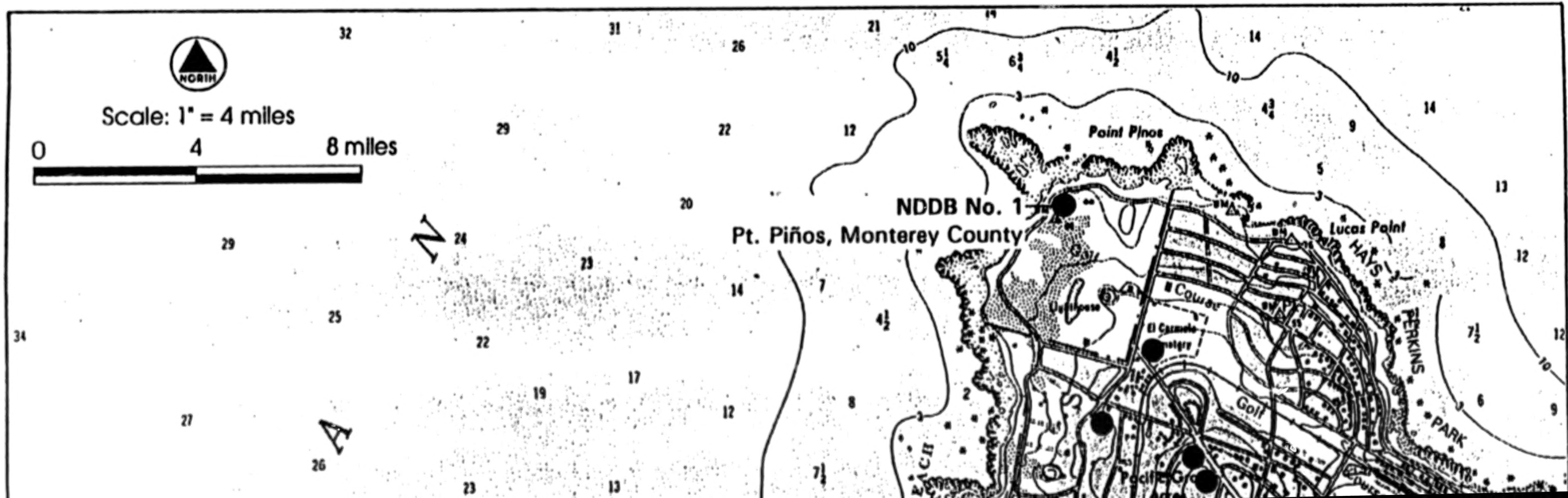
FIGURE 24

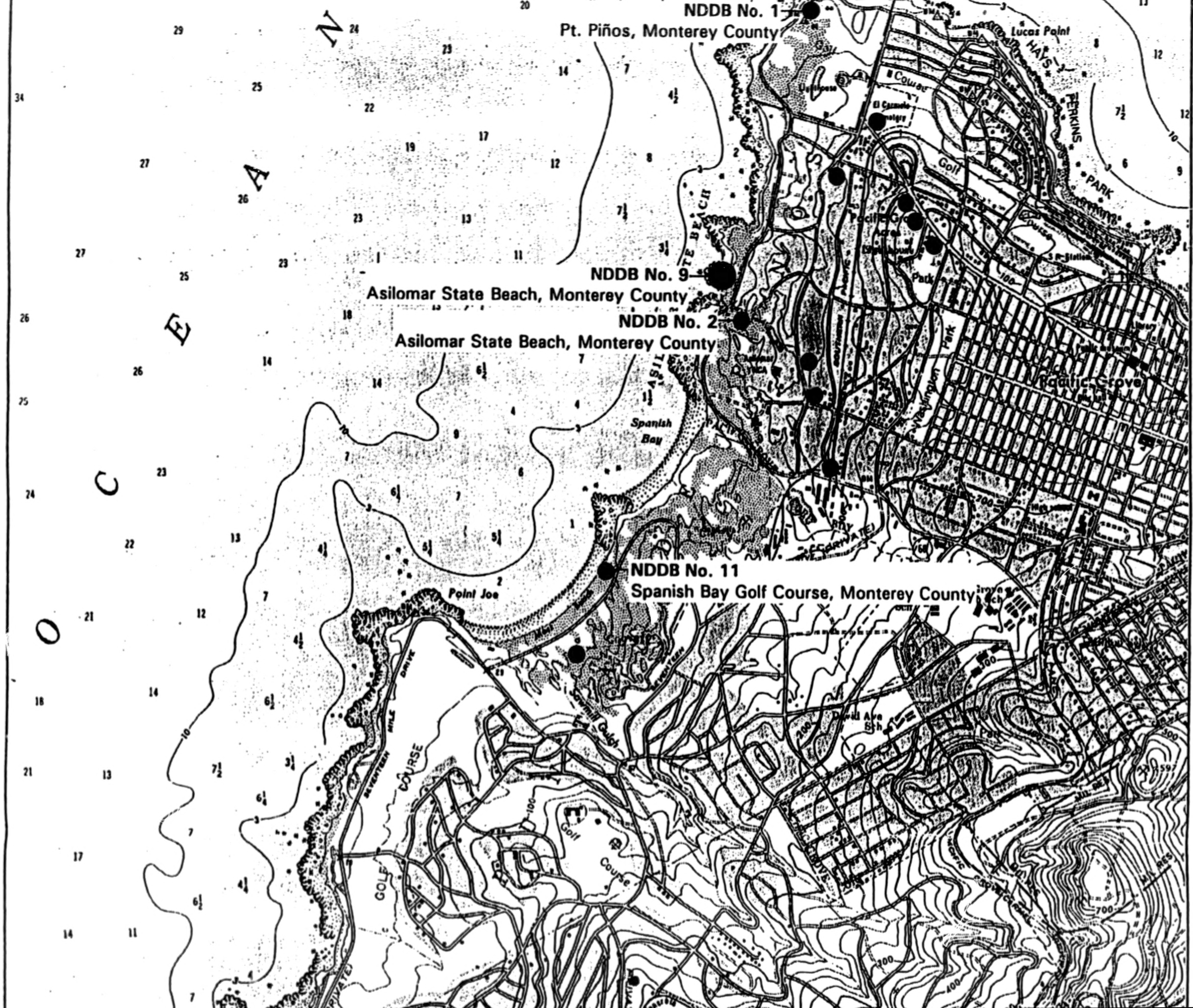


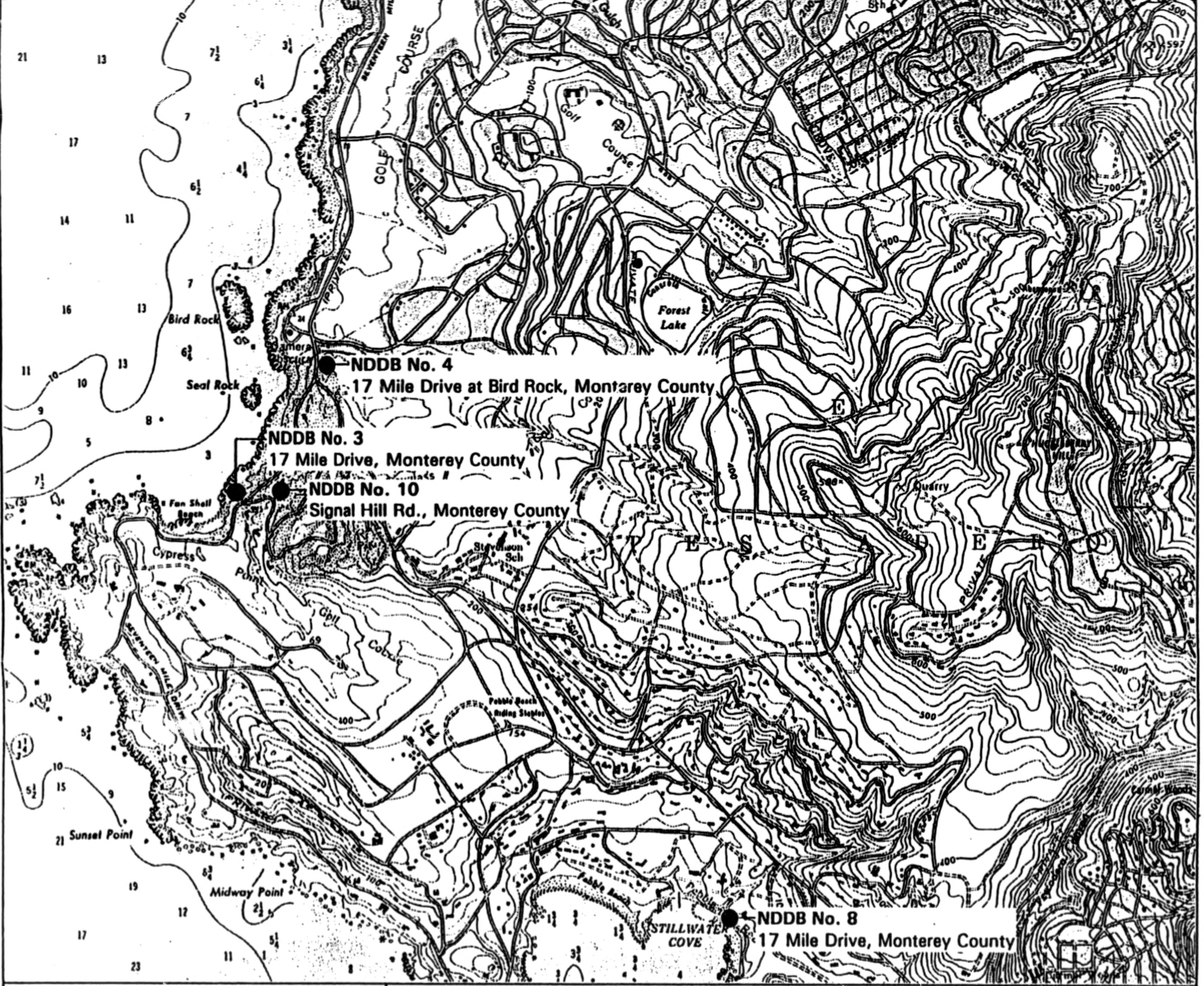
Approximate Distribution of *Layia carnosa*
RECOVERY PLAN

FIGURE 24

BEST COPY AVAILABLE


NORTH
Scale: 1" = 4 miles
0
4
8 miles
NDDB No. 1
Pt. Piños, Monterey County
Point Pinos
Lucas Point
HAYS
PERKINS
PARK
Golf
El Carmelo Cemetery
Lighthouse
N
A


NDDB No. 1
Pt. Piños, Monterey County
NDDB No. 9
Asilomar State Beach, Monterey County
NDDB No. 2
Asilomar State Beach, Monterey County
NDDB No. 11
Spanish Bay Golf Course, Monterey County
OCEAN
Lucas Point
Spanish Bay
Point Joe
Pacific Grove
Golf Course
Seventeen Mile Drive
Perkins Park

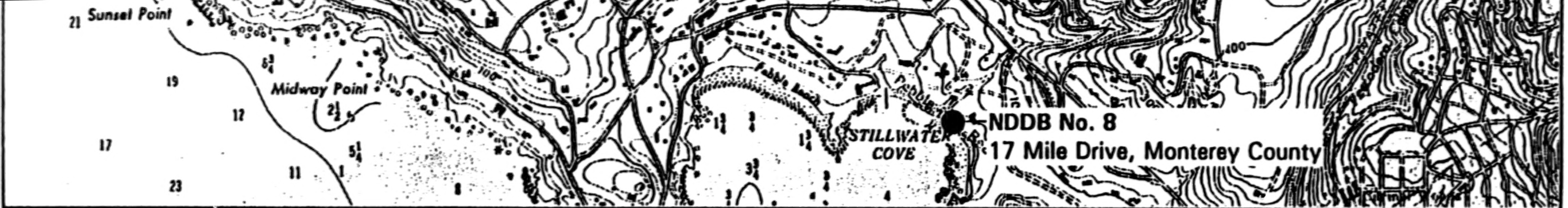


NDDB No. 4
17 Mile Drive at Bird Rock, Montarey County

NDDB No. 3
17 Mile Drive, Monterey County

NDDB No. 10
Signal Hill Rd., Monterey County

NDDB No. 8
17 Mile Drive, Monterey County



Approximate Distribution of
Lupinus tidestromii
RECOVERY PLAN

FIGURE 29

BEST COPY AVAILABLE

4